AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(NASA-SP-7011(350)) AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 350) (NASA) 56 p CSCL 06E

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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



INTRODUCTION

This issue of Aerospace Medicine and Biology (NASA SP-7011) lists 152 reports, articles and other documents originally announced in May 1991 in Scientific and Technical Aerospace Reports (STAR) or in International Aerospace Abstracts (IAA). The first issue of Aerospace Medicine and Biology was published in July 1964.

Accession numbers cited in this issue are:

STAR (N-10000 Series) N91-16988 — N91-19023 IAA (A-10000 Series) A91-24169 — A91-28400

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals.

Seven indexes—subject, personal author, corporate source, foreign technology, contract, report number, and accession number—are included.

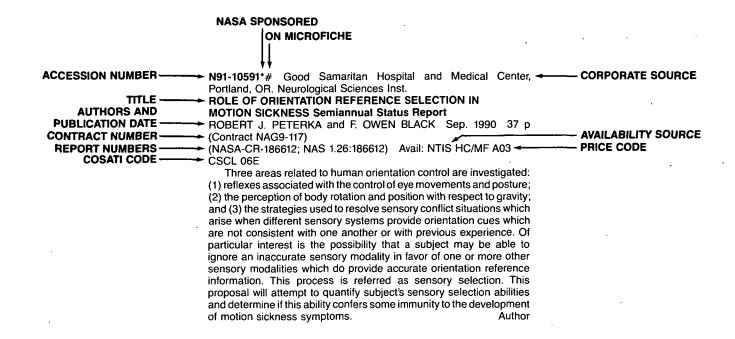
A cumulative index for 1991 will be published in early 1992.

Information on availability of documents listed, addresses of organizations, and NTIS price schedules are located at the back of this issue.

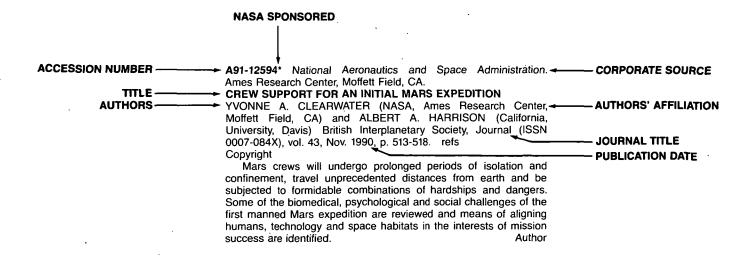
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AEROSPACE MEDICINE AND BIOLOGY A CO

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JUNE 1991

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LIFE SCIENCES (GENERAL)

A91-24780* Florida State Univ., Tallahassee.
MICROFILAMENTS DURING SEA URCHIN FERTILIZATION FLUORESCENCE DETECTION WITH RHODAMINYL
PHALLOIDIN

C. A. CLINE and GERALD SCHATTEN (Florida State University, Tallahassee) Gamete Research (ISSN 0148-7280), vol. 14, 1986, p. 277-291. Research supported by NiH and NSF. refs (Contract NAG2-340) Copyright

A91-24781° Florida State Univ., Tallahassee. MOTILITY AND CENTROSOMAL ORGANIZATION DURING SEA URCHIN AND MOUSE FERTILIZATION

HEIDE SCHATTEN and GERALD SCHATTEN (Florida State University, Tallahassee) Cell Motility and the Cytoskeleton (ISSN 0271-6585), vol. 6, 1986, p. 163-175. refs (Contract NAG2-340; NIH-HD-12913; NSF PCM-83-15900) Copyright

It is noted that microfilaments are essential for incorporation of sperm in sea urchins and for pronuclear apposition in mice. The ability of sea urchin sperm to fertilize eggs is lowered by latrunculin, giving evidence that acrosomal microfilaments are of importance to the process of fertilization. Due to the uncertainty regarding the presence of microfilaments in various mammalian sperm, it is interesting that latrunculin does not noticeably affect the ability of mouse sperm to fertilize oocytes. The movements of the sperm and egg nuclei at the time of sea urchin fertilization are dependent on microtubules arranged into a radial monastral array (the sperm aster). In the mouse egg, microtubule activity is also required during pronuclear apposition, but they are arranged by a number of egg cytoplasmic sites. Results of the investigations show that both microtubules and microfilaments are necessary for the successful completion of fertilization in both mice and sea urchins, but at different stages. Also, it is demonstrated that centrosomes are contributed by the sperm in the process of sea urchin fertilization, but in mammals they may be inherited maternally.

A91-24784* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

BIOCONVECTIVE PATTERNS, SYNCHRONY, AND SURVIVAL

DAVID A. NOEVER (NASA, Marshall Space Flight Center, Huntsville, AL) Physical Review Letters (ISSN 0031-9007), vol. 65, Oct. 8, 1990, p. 1953-1956. refs

Copyright

With and without bioconvective pattern formation, a theoretical model predicts growth in light-limited cultures of motile algae. At the critical density for pattern formation, the resulting doubly exponential population curves show an inflection. Such growth corresponds quantitatively to experiments in mechanically unstirred cultures. This attaches survival value to synchronized pattern formation.

A91-25297

POTENTIAL OF THE REDOX STATE OF THE RABBIT BRAIN CORTEX UNDER HYPNOSIS (IMMOBILIZATION STRESS) [POTENTSIAL OKISLITEL'NO-VOSSTANOVITEL'NOGO SOSTOIANIIA KORY GOLOVNOGO MOZGA KROLIKA VO VREMIA GIPNOZA /IMMOBILIZATSIONNOGO STRESSA/]
T. B. SHWETS-TENETA-GURII (AN SSSR, Institut Vysshei Nervnoi Deiatel'nostiri Neirofiziologii, Moscow, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 315, no. 4, 1990, p. 1014-1017. In Russian. refs

A91-25329#

EFFECTS OF COLD, NOISE AND WHOLE BODY VIBRATION STRESS ON NEUROTRANSMITTERS IN THE RAT BRAIN HIROYUKI NAKAMURA, SEIICHI NOHARA, HIDEKI NAKAMURA, HIROFUMI NAGASE (Kanazawa University, Japan), KOUICHI TSUNASHIMA (Hospital for Mental, Nervous and Muscular Disorder, Kodaira, Japan) et al. Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 27, Sept. 1990, p. 57-66. In Japanese, with abstract in English. refs

Central nervous system reactions of organisms to cold, noise, and whole body vibration (WBV) stress are studied. The levels of dopamine (DA), homovanillic acid (HVA), and substance-P-like and neurotensinlike immunoreactivities (SP-LI, NT-LI) in frontal cortex (FC), nucleus accumbens (NAc), striatrum (STR) and hypothalamus (HYP) of rats exposed to cold of 4 C, noise of 102 dB, or WBV of 4 G with duration 90 min are examined. The results indicate that mesofrontal and mesoaccumbens DA systems are activated by cold, noise, and WBV. Reactions in the HYP are assumed to be involved in the thermoregulation of the organisms.

A91-26538

LARGEST KNOWN MICROBIALITES DISCOVERED IN LAKE VAN, TURKEY

S. KEMPE, G. LANDMANN, A. REIMER (Hamburg, Universitaet, Federal Republic of Germany), J. KAZMIERCZAK (Polska Akademia Nauk, Zaklad Paleobiologii, Warsaw, Poland), T. KONUK (Ninth September University, Izmir, Turkey) et al. Nature (ISSN 0028-0836), vol. 349, Feb. 14, 1991, p. 605-608. Research supported by DFG, Stiftung Volkswagenwerk, Polska Akademia Nauk, et al. refs

The discovery is reported of enormous towerlike microbialites from alkaline Lake Van in eastern Anatolia. Growth is by mats of coccoid cyanobacteria permineralizing in situ with aragonite and by inorganically precipitated calcite. Certain aspects of these microbialites resemble Proterozoic marine stromatolites. C.D.

A91-26800#

DAY-NIGHT VARIATION OF HEAT LOSS RESPONSE TO INTERNAL BODY HEATING IN FREELY MOVING RATS OSAMU SHIDO and TETSUO NAGASAKA (Kanazawa University, Japan) Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 27, March 1990, p. 9-15. refs (Contract MOESC-61870009; MOESC-62770114)

A91-26845#

THE BIOCHEMICAL EFFECTS OF 2G THREE-WEEK CONTINUOUS CENTRIFUGATION ON BONE STRENGTH AND MUSCLE TISSUE COMPONENTS IN COCKERELS

SHUSHICHI TAKAHASHI, HIDEYUKI ITO, TAKAHIRO TAIRA, JUNKO YAMAZAKI (Nihon University, Tokyo, Japan), MASAKATSU SHIOYA (Nihon University, Fujisawa, Japan) et al. Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 27, June 1990, p. 29-34. refs

Tests of bone strength and muscle quality were conducted using cockerels exposed for 21 days to 2G centrifugal acceleration from the spine to the legs. It was found that both the breaking energy and breaking force of femurs and tibias were significantly high in the 2G group than in the 1G control group. The density, total protein, and residual components extracted from tibia proteins were significantly higher in the 2G group than in the 1G control. The test proved that 2G acceleration increased the cockerels' bone strength, bone density, and bone protein, and increased both RNA and protein in the muscle.

A91-27964* Wright State Univ., Dayton, OH. HABITUATION OF MOTION SICKNESS IN THE CAT

GEORGE H. CRAMPTON and JAMES B. LUCOT (Wright State University, Dayton, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 212-215. refs

(Contract NCC2-220)

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Thirty femal cats were subjected to a motion sickness stimulus in three series of tests. A series consisted of five tests given biweekly, weekly, or daily. Each test consisted of 30 min of stimulation followed by 1 min of rest, and series were separated by a period of not less than 14 d. Retching was the dependent variable. No habituation (reduction in the incidence of retching) was found with biweekly testing but pronounced habituation was observed with weekly and daily testing. The 30 cats were divided evenly into high and low susceptibility groups based on the results of the biweekly tests. The rate of habituation was the same for the two susceptibility groups in both the weekly and daily series.

Author

A91-28156* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

TOWARD MODELING A DYNAMIC BIOLOGICAL NEURAL NETWORK

M. D. ROSS (NASA, Ames Research Center, Moffett Field, CA), J. E. DAYHOFF (Judith Dayhoff and Associates, Mountain View, CA), and D. H. MUGLER (Akron, University, OH) Mathematical and Computer Modelling (ISSN 0895-7177), vol. 13, no. 7, 1990, p. 97-105. refs

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The organization of a mammalian macular endorgan is interpreted on physical and engineering principles. Having accomplished this task, it is possible to mathematically and symbolically model information processing by the macular neural network. A complex symbolic model is produced through use of mathematical notations that describe the functioning system. The model, consisting of six tiers, is constructed to mimic the neural system. On the basis of initial simulations, it is concluded that the network functions best when some of the detecting elements (i.e., type I hair cells) are weakly inhibitory. The simulations also illustrate the importance of disinhibition of receptors located in the third tier in shaping nerve discharge patterns at the sixth tier in the model system.

A91-28158* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

CRYSTALLIZATION OF THE FAB FROM A HUMAN MONOCLONAL ANTIBODY AGAINST GP 41 OF HUMAN IMMUNODEFICIENCY VIRUS TYPE I

ELENA CASALE, XIAO-MIN HE, ROBERT S. SNYDER, DANIEL C. CARTER (NASA, Marshall Space Flight Center, Huntsville, AL), ELISABETH WENISCH, ALOIS JUNGBAUER, CHRISTA TAUER,

FLORIAN RUKER (University of Agriculture and Forestry, Vienna, Austria), and PIER GIORGIO RIGHETTI (Milano, Universita, Milan, Italy) Journal of Molecular Biology (ISSN 0022-2836), vol. 216, 1990, p. 511, 512. Research supported by ASI, NASA, and BMFWF. refs
Copyright

A monoclonal IgG antibody directed against gp 41 from the human immunodeficiency virus (HIV-1) has been crystallized in both intact and Fab forms. Crystals of the intact antibody grow as tetragonal-like prisms too small for conventional X-ray analysis. However, the Fab portion of the antibody produces suitable platelike crystals which belong to the space group P2(1)2(1)2(1) with unit cell constants of a = 66.5 A, b = 74.3 A, and c = 105.3 A. There is one molecule of Fab in the asymmetric unit. The Fab crystals show diffraction to d-spacings less than 3.0 A. Author

N91-17529# Arizona State Univ., Tempe. Dept. of Physics. MICROWAVE RESONANCES IN DNA

S. M. LINDSAY Aug. 1990 29 p Sponsored in part by Health Effects Research Lab., Research Triangle Park, NC (Contract EPA-68-02-4105)

(PB90-261520; EPA/600/1-90/007) Avail: NTIS HC/MF A03 CSCL 06C

Spectroscopic studies are described of DNA which were undertaken to better understand a physical basis for microwave absorption by this molecule. Three types of studies are described. The low frequency scattered light spectrum of DNA was studied by two methods. First, Raman scattering of the vibrational modes of DNA films was studied down to about 4 wavenumbers/cm using a high contrast grating monochrometer. The lowest lying vibrational mode was found at frequencies between 12 and 30/cm, depending upon the specific water content, counter-ion, and crystal structure. Second, a tandem interferometer was used to study the spectrum from about 0.1 to 10/cm (3 to 300 GHz). Studies of Li-DNA films and solutions of the plasmid pUC8 found no evidence of GHz resonances in the scattered light spectrum or in the Brillouin linewidths. The coupling of GHz acoustic modes to the hydration shell of DNA was studied via a coupled mode analysis of Brillouin spectra. The primary hydration shell relaxes at about 40 ps at room temperature and might permit resonances at frequencies between 20 and 200 GHz. However, non were observed. Attempts to repeat experiments that appeared to show a resonance mode near 0.6 GHz were unsuccessful. Author

N91-17530# Corvallis Environmental Research Lab., OR. BIODIVERSITY AND HUMAN IMPACTS

J. R. BARKER, S. HENDERSON, R. F. NOSS, and D. T. TINGEY 1990 40 p Prepared in cooperation with NSI Technology Services Corp., Corvallis, OR

(PB90-263963; EPA/600/D-90/144) Avail: NTIS HC/MF A03 CSCL 06C

The basic issue that drives all concerns about biodiversity is the accelerating and irreplaceable loss of genes, species, populations, and ecosystem through environmental degradation such as deforestation, strip mining and other developmental projects. Associated with these losses are reduced options for cultural and biological adaptation to an uncertain and ever changing environment; possible disruption of essential ecological processes and services; and loss of products obtained from nature (presently or potentially). In addition, it is suggested that species, ecosystems and other elements of biodiversity are valuable in and of themselves and thus should be protected and enhanced. Biodiversity values can be categorized as human utilitarian; ecological utilitarian; cultural, recreational, and esthetic; and ethical or intrinsic.

Author

N91-17531*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

A CULTURE VESSEL WITH LARGE PERFUSION AREA TO VOLUME RATIO Patent Application

DAVID A. WOLF, inventor (to NASA), CLARENCE F. SAMS, inventor (to NASA), and RAY P. SCHWARZ, inventor (to NASA) 11 Dec. 1990 25 p

(NASA-CASE-MSC-21662-1; NAS 1.71:MSC-21662-1; US-PATENT-APPL-SN-625345) Avail: NTIS HC/MF A03 CSCL

An improved bio-reactor vessel and system useful for carrying out mammalian cell growth in suspension in a culture media are presented. The main goal of the invention is to grow and maintain cells under a homogeneous distribution under acceptable biochemical environment of gas partial pressures and nutrient levels without introducing direct agitation mechanisms or associated disruptive mechanical forces. The culture chamber rotates to maintain an even distribution of cells in suspension and minimizes the length of a gas diffusion path. The culture chamber design is presented and discussed.

N91-17532# Trondheim Univ. (Norway). Dept. of Physics. A SYSTEM ANALYTICAL AND EXPERIMENTAL STUDY OF GRAVITROPIC REACTIONS IN PLANTS Thesis

ELI ZACHARIASSEN Jan. 1988 94 p Sponsored by Norwegian Research Council for Science and the Humanities (ETN-91-98586) Avail: NTIS HC/MF A05

Plant movements, oscillative growth movements, and circumnutations are studied. The gravitropic response to gravitropic stimuli is described. Preliminary studies for an experiment to be performed in Spacelab are presented, where the response of Avena coleoptiles is investigated under weightlessness. The circumnutations of the Helianthus hypocotyl are dealt with. Experimental and theoretical investigations of these oscillative movements under different g levels are presented. The effects of Li(x) on circumnutations of sunflower hypocotyls are studied. The equipment used to compensate plant movements is described. Examples are given on the use of the equipment in studies of phototropic movements, circumnutations, and circadian leaf movements.

N91-18568# Princeton Univ., NJ. Dept. of Physics. DEVELOPMENT AND APPLICATION OF PHOTOSENSITIVE DEVICE SYSTEMS TO STUDIES OF BIOLOGICAL AND ORGANIC MATERIALS Progress Report No. 1, 1 Jan. - 31 Dec. 1990

SOL M. GRUNER and GEORGE T. REYNOLDS 12 Jul. 1990 22 p

(Contract DE-FG02-87ER-60522)

(DE91-005130; DOE/ER-60522/4) Avail: NTIS HC/MF A03

This report discusses the following basic research accomplishments: new x ray structure determination methods were developed and applied to biomembrane lipid phases; a novel mechanism for general anesthesia was proposed; the elastic properties of membranes were investigated, both theoretically and experimentally; the effects of high pressures on membranes were studied; neutron diffraction was used to probe mesophase structure; and novel lipid and surfactant systems are characterized. Also discussed are instrumentation accomplishments.

N91-18569# Argonne National Lab., IL. Chemistry Div. AN EXTENDED MODEL FOR ELECTRON SPIN POLARIZATION IN PHOTOSYNTHETIC BACTERIA

ANDREA L. MORRIS, JAMES R. NORRIS (Chicago Univ., IL.), and MARION C. THURNAUER 1990 14 p Presented at the 2nd Feldafing International Workshop, Feldafing, Fed. Republic of Germany, 24-27 Mar. 1990

(Contract W-31-109-ENG-38)

(DE91-006091; CONF-9003209-2) Avail: NTIS HC/MF A03

We have developed a general model for electron spin polarization which includes contributions from both CIDEP (chemically induced dynamic electron polarization) and CRP (correlated radical polarization). In this paper, we apply this model to sequential electron transfer in photosynthetic bacteria. Our model calculates the density matrix for the P(sup +)I(sup minus) radical pair and transfers the polarization as it develops to the P(sup +)Q(sup minus) radical pair. We illustrate several possible cases. One case is equivalent to CIDEP; no interactions are included on the secondary radical pair, P(sup +)Q(sup minus). Another approximates CRPP by either increasing the transfer rate from

P(sup +)I(sup minus) to P(sup +)Q(sup minus) or restricting interactions to the secondary radical pair, P(sup +)Q(sup minus). Others allow interactions on both the primary and secondary radical pairs with various transfer rates.

N91-18570# Brandeis Univ., Waltham, MA. CARBON AND HYDROGEN METABOLISM OF GREEN ALGAE IN LIGHT AND DARK Progress Report

1990 5 p

(Contract DE-FG02-86ER-13486)

(DE91-006542; DOE/ER-13486/5) Avail: NTIS HC/MF A01

The focus of this project was the elucidation of anaerobic metabolism in ecuaryotic green algae, chlamydomonas reinhardii. Chlamydomonas is a versatile organism that can grow under disparate conditions such as fresh water takes and sewage ponds. The cell photoassimilates CO2 aerobically and anaerobically, the latter after adaptation to a hydrogen metabolism. It can recall the knallgas or oxyhydrogen reaction and utilize hydrogen the simplest of all reducing agents for the dark assimilation of CO2 by the photosynthetic carbon reduction cycle. The dark reduction with hydrogen lies on the border line between autotrophic and heterotrophic carbon assimilation. Both autotrophic heterotrophic bacteria are known in which molecular hydrogen can replace either inorganic or organic hydrogen donors. Here the dark reduction of CO2 acquires a particular importance since it occurs in the same cell that carries on photoreduction and photosynthesis. It is demonstrated that the algae chloroplast possesses a respiratory capacity. It seems likely Chlamydomonas may have retained the chloroplastic respiratory pathway because of the selective advantage provided to the algae under a wide range of environmental conditions that the cells experience in nature. The ability to cycle electrons and poise the reduction level of the photosynthetic apparatus under aerobic and microaerobic conditions could allow more efficient CO2 fixation and enhanced growth under unfavorable conditions or survival under more severe conditions.

N91-18571# Clemson Univ., SC. Dept. of Biological Sciences. THE MAGNESIUM CHELATION STEP IN CHLOROPHYLL BIOSYNTHESIS

JON WEINSTEIN Nov. 1990 8 p (Contract DE-FG09-89ER-13989; DE-FG09-87ER-13768) (DE91-006619; DOE/ER-13989/2) Avail: NTIS HC/MF A02

In photosynthetic organisms, the biogenesis of energy transducing membranes requires the coordinate synthesis of prosthetic groups, proteins, and various lipids. Two of the major prosthetic groups, chlorophyll and heme, share a common biosynthetic pathway that diverges at the point of metal insertion into protoporphyrin IX (Proto). Insertion of iron leads to the formation of hemes, while insertion of magnesium is the first step unique to chlorophyll formation. This project is directed toward identifying the enzyme(s) responsible for magnesium chelation and elucidating the mechanism which regulates the flux of precursors through the branch point enzymes in isolated chloroplasts. Using intact chloroplasts from greening cucumber cotyledons, the ATP requirement for Mq-Proto formation was confirmed. Use of non-hydrolyzable ATP analogs, uncouplers and ionophores has led to the conclusions that ATP hydrolysis is necessary, but that this hydrolysis is not linked to the requirement for membrane intactness by transmembrane ion gradients or electrical potentials. The enzyme(s) are flexible with respect to the porphyrin substrate specificity, accepting porphyrins with -vinyl, -ethyl, or -H substituents at the 2 and 4 positions. The activity increases approximately four-fold during greening. Possible physiological feedback inhibitors such as heme, protochlorophyllide, and chlorophyllide had no specific effect on the activity. The activity has now been assayed in barely, corn and peas, with the system from peas almost ten-fold more active than the cucumber system. Work is continuing in pea chloroplasts with the development of a continuous assay and investigation of the feasibility of characterizing an active, organelle-free preparation. DOE

N91-18993*# Oakwood Coll., Huntsville, AL. Dept. of Biological Sciences.

VISUALIZATION OF YEAST CHROMOSOMAL DNA

SETH LUBEGA In Alabama Univ., Research Reports: 1990 NASA/ASEE Summer Faculty Fellowship Program 6 p Oct. 1990

(Contract NGT-01-002-099)

Avail: NTIS HC/MF A16 CSCL 06/3

The DNA molecule is the most significant life molecule since it codes the blue print for other structural and functional molecules of all living organisms. Agarose gel electrophoresis is now being widely used to separate DNA of virus, bacteria, and lower eukaryotes. The task was undertaken of reviewing the existing methods of DNA fractionation and microscopic visualization of individual chromosonal DNA molecules by gel electrophoresis as a basis for a proposed study to investigate the feasibility of separating DNA molecules in free fluids as an alternative to gel electrophoresis. Various techniques were studied. On the molecular level, agarose gel electrophoresis is being widely used to separate chromosomal DNA according to molecular weight. Carl and Olson separate and characterized the entire karyotype of a lab strain of Saccharomyces cerevisiae. Smith et al. and Schwartz and Koval independently reported the visualization of individual DNA molecules migrating through agarose gel matrix during electrophoresis. The techniques used by these researchers are being reviewed in the lab as a basis for the proposed studies.

Author

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AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A91-25210

MEDICAL SUPPORT OF PARACHUTE JUMPS [SPETSIFIKA MEDITSINSKOGO OBESPECHENIIA PARASHIUTNYKH PRYZHKOV]

V. S. VIDENIN, M. M. ODINAK, A. IU. EMEL'IANOV, V. A. GORISLAVETS, and V. L. BARABASH Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), Nov. 1990, p. 52, 53. In Russian. Copyright

Physiological stress reactions in a parachute jumper occurring before and during the parachute jump are discussed together with the danger associated with landing and the specific types of injuries most commonly occurring during the parachute opening and/or landing. It is pointed out that repeated exposures to impact trauma during the parachute opening and landing might cause permanent degenerative-distrophic changes in the spinal column. Measures for the prevention of neurologic disorders in parachute jumpers are discussed.

A91-25250

FUNCTIONAL ASYMMETRY OF PAIRED ORGANS AND THE PROFESSIONAL EFFICIENCY OF PILOTS [FUNKTSIONAL'NAIA ASIMMETRIIA PARNYKH ORGANOV I

PROFESSIONAL NAIA ASIMMETHIA FARITATI ORGANOVI
PROFESSIONAL'NAIA EFFEKTIVNOST' PILOTOVI
V A BODBOV T A DOBBOKHOTOVA and A G FEDORI

V. A. BODROV, T. A. DOBROKHOTOVA, and A. G. FEDORUK (AN SSSR, Institut Psikhologii, Moscow, USSR) Fiziologiia Cheloveka (ISSN 0131-1646), vol. 16, Nov.-Dec. 1990, p. 142-148. In Russian. refs

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Data are presented from a study in which the functional efficiency of the upper and lower limbs, eyes, and ears was correlated with the professional efficiency of 749 pilots. It was found that most pilots exhibited right-side asymmetry of the paired organs (91 percent with respect to the upper limb and 55 percent with respect to the lower limb, 75 percent with respect to vision, and 73 percent auditory asymetry). It was also found that pilots in

the highest qualification group had the most prominently expressed right-side asymetry, especially with respect to auditory organs, due most likely to an increase of this asymmetry during their professional life. Among pilots characterized by low reliability, the majority exhibited a mixed type of asymmetry (i.e., some organs had left-sided asymmetry or were functionally symmetric).

A91-25296

THERMAL-NEUTRALITY ZONE IN THE HUMAN BODY UNDER THERMAL ADAPTATION [ZONA TERMICHESKOI NEITRAL'NOSTI CHELOVEKA PRI TEPLOVOI ADAPTATSII]

M. D. KHUDAIBERDIEV and F. F. SULTANOV (AN TSSR, Institut Fiziologii i Eksperimental'noi Patologii Aridnoi Zony, Ashkhabad, Turkmen SSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 315, no. 4, 1990, p. 1011-1014. In Russian. refs Copyright

The boundaries of the temperature-neutrality zone in the human body under seasonal adaptation were investigated in 16 subjects. Experimental results indicate that seasonal adaptation in humans is accompanied by a narrowing of the thermal-neutrality zone.

I.S.

A91-25330

RELATION BETWEEN CARDIOVASCULAR RESPONSES AND BODY TILTING ANGLES

MASAMICHI SUDOH, KENJI KAWAKAMI, KUNINOBU YOKOTA, MASATOSHI SHIOTA, SACHIO IKAWA (Jikei University, Tokyo, Japan) et al. Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 27, Sept. 1990, p. 75-83. In Japanese, with abstract in English. refs Copyright

Experimental studies on the relationships cardiovascular response and body tilting angles are presented. Twenty-eight healthy males are examined at the positions of 10, 30, 45, 70, and 90 deg head up and 10, 30, and 45 deg head down. Stroke volume (SV), cardiac output (CO), heart rate (HR), and transthoracic impedance (Zo) are recorded and processed using a personal coomputer; systolic blood pressure (SBP) and diastolic blood pressure (DBP) are measured by an automatic digital sphygmomanometer every minute. Mean arterial pressure (MAP) and pulse pressure (PP) from SBP, and total peripheral resistance (TPR) from MAP and CO are calculated. The results are presented in graphs and extensive tables and characterized in detail. It is found that head-up tilt produces increases in DBP, HR, MAP, and TPR; decreases in PP, SV, and CO; but no change in SBP.

Y.P.Q.

A91-26555

CHANGES IN UPPER AIRWAY RESISTANCE DURING PROGRESSIVE NORMOCAPNIC HYPOXIA IN NORMAL MEN

F. MALTAIS, L. DINH, Y. CORMIER, and F. SERIES (Hopital Laval; Universite Laval, Sainte Foy, Canada) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, Feb. 1991, p. 548-553. Research supported by the National Center of Excellence of Canada. refs
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The effect of progressive normocapnic hypoxia on the nasal and pharyngeal resistance was investigated in nine human subjects in whom progressive normocapnic hypoxia was achieved by a rebreathing method. Airway resistance was calculated from measurements of upper-airway pressures with two low-bias flow catheters, one at the tip of the epiglottis and the other in the posterior nasopharynx. The air flow was measured by a pneumatachograph connected to the tightly fitting mask. Results indicate that nasal and pharyngeal resistances decreased during progressive normocapnic hypoxia. It is suggested that increases in central respiratory drive, functional residual capacity, and nasal mucosal vasoconstriction may be responsible for the decrease.

I.S.

A91-26556 **EVIDENCE FOR HYPOXIC DEPRESSION OF CO2-VENTILATION RESPONSE IN CAROTID BODY-RESECTED HUMANS**

YOSHIYUKI HONDA and IKKO HASHIZUME (Chiba University. Japan) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, Feb. 1991, p. 590-593. refs

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The effect of a carotid-body resection in humans on the CO2-ventilation response was investigated by comparing the steady-state CO2-ventilation response curves with hyperoxia and mild hypoxia in five carotid-body-resected (BR) patients with those of control patients. It was found that, compared with control patients, the hypoxic CO2-ventilation response in BR patients was significantly depressed. It is suggested that the depression resulted. at least in part, from a modulation of the brain-stem neural mechanism due to the loss of afferent discharges from the carotid body.

A91-26557 CLASSICAL CONDITIONING OF VENTILATORY RESPONSES IN HUMANS

JORGE GALLEGO and PIERRE PERRUCHET (Paris VI, Universite, Journal of Applied Physiology (ISSN 0161-7567), vol. 70, Feb. 1991, p. 676-682. Research supported by the Institut National de la Sante et de la Recherche Medicale. refs

Copyright

The effect of classical conditioning on the ventilatory responses in humans was examined in subjects, assigned either to an experimental or a control group, in whom an auditory and hypoxic stimuli were either paired or not paired, respectively. The results on the patterns of breathing obtained in two groups of subjects provide evidence that an auditory stimulus that was paired repeatedly with a hypoxic stimulus may acquire the ability to elicit a ventilatory response due, specifically, to pairing. It is suggested that conditioned vegetative responses may considerably enhance the adaptability of organisms to varying environmental conditions.

A91-26558

ATTENUATED CAROTID BODY HYPOXIC SENSITIVITY AFTER PROLONGED HYPOXIC EXPOSURE

KOICHIRO TATSUMI, CHERYL K. PICKETT, and JOHN V. WEIL (Colorado, University, Denver; Chiba University, Japan) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, Feb. 1991, p. 748-755. refs

(Contract NIH-HL-14985)

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The relative importance of the central and the peripheral mechanisms in the decreased hypoxic ventilatory response (HVR) that accompanies prolonged exposure to hypoxia was investigated in cats exposed to simulated altitude of 5500 m for 3-4 weeks. The ventilatory responses to hypoxia were measured in each cat before and after the exposure, while the carotid sinus nerve (CSN) responses (which had to be measured by an invasive technique) in experimental group were compared to those in the control group. It was found that a decreased HVR response to hypoxia was associated with a parallel decrease in the CSN response. It is suggested that a sustained exposure to severe hypoxia leads to a diminished responsiveness of the peripheral chemoreceptor to and to an attenuated central-nervous-system chemosensory translation, which together may contribute to the decrease of HVR observed in chronic hypoxia.

A91-26559 AIR TRAVEL ACROSS FOUR TIME ZONES IN COLLEGE **SWIMMERS**

PATRICK J. O'CONNOR, WILLIAM P. MORGAN, KELLI F. KOLTYN, JOHN S. RAGLIN, JOEL G. TURNER (Arizona State University, Tempe; Wisconsin, University, Madison; W.S. Middleton Memorial Veterans Administration; Indiana University, Bloomington) Journal of Applied Physiology (ISSN 0161-7567), vol. 70, Feb. 1991, p. 756-763. Research supported by the U.S. Olympic Committee.

Copyright

The effect of air travel across several time zones on the athletic performance and the physiological parameters of trained athletes was investigated in 18 female and 22 male college swimmers flown across four time zones in the east-to-west (E-W) direction and, three weeks later, in the west-to-east (W-E) direction. Results of two-way repeated-measured analyses of variance showed that, in comparison to preflight values, the pre- and postexercise cortisol levels decreased after the E-W travel and increased after the W-E travel. The resting and exercise heart-rate responses to air travel were small in magnitude, with their significance dependent on the direction of travel. However, the effort sense was not altered by air travel, and there were significant improvements in terms of the mood and the reduction in muscle soreness after both the E-W and the W-E travel. Responses of male and female subjects to air travel were similar.

A91-26560

ALVEOLAR GAS COMPOSITION AND EXCHANGE DURING DEEP BREATH-HOLD DIVING AND DRY BREATH HOLDS IN **ELITE DIVERS**

GUIDO FERRETTI, MARIO COSTA, MASSIMO FERRIGNO, BRUNO GRASSI, CLAUDIO MARCONI (Geneve, Universite, Geneva, Switzerland; CNR, Istituto di Tecnologie Biomediche Avanzate, Milan, Italy; New York, State University, Buffalo) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 70, Feb. 1991, p. 794-802. Research supported by CNR, Istituto Iperbarico. and Circolo del Giardino of Italy. refs (Contract NOAA-NA-81AAD0027)

The circulatory changes and the alveolar gas composition and exchange, as well as the energetics of deep diving were investigated in three elite divers (EDs) and in control subjects by measuring the end-tidal O2 and CO2 pressures, expired volume, blood lactate concentration, and arterial blood O2 saturation (dry breath holds, BHs, only). It was found that the EDs were able to cope better than subjects with no diving experience with extreme BH diving depths and duration by means of a series of adaptations. It is suggested that an effective diving response consisting of peripheral (muscle) vasoconstriction reflex occurs in EDs during deep dives, as was evidenced by the observed shift from aerobic to anaerobic metabolism. Additional features of adaptation. observed in EDs but not in control subjects, were blunted ventilatory responses to hypoxia and/or hypercapnia.

A91-26797 CIRCADIAN RHYTHM, SLEEP, AND FATIGUE IN AIRCREWS **OPERATING ON LONG-HAUL ROUTES**

ALEXANDER SAMEL and HANS-MARTIN WEGMANN IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 404-422. refs

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Aircrews operating on world-wide routes have to cope with rapid time-zone transitions, when flying transmeridian sections, and with duty periods of varying duration, which may commence at any time of the day or the night. These conditions lead to irregularities of sleep (Nicholson, 1972) and to a disparity between internal body time and the external time of the environment (Klein and Wegmann, 1980). The interference of the irregular pattern of flight duty with the natural sleep-wake cycle and with the circadian system affects physiological as well as mental and behavioral functions. Sleep is often disturbed because it is attempted during an inappropriate phase of the circadian system, or at periods when local environmental conditions are disadvantageous. Disturbances of circadian rhythmicity are caused desynchronization from the new local time. Both sources of interference, i.e., shifted work and shifted time, may have implications for optimal safety and efficiency in air carrier operations. Author

A91-26846#

ALTERATION OF CIRCADIAN RHYTHM OF PLASMA CORTISOL AFTER EASTWARD FLIGHT AND THE EFFECT OF LIGHT EXPOSURE

NAOKO TAJIMA, AKIRA SASAKI, HIROFUMI OHKOSHI, MIKIO UEMATSU, ICHIRO ASUKATA (Japan Airlines, Flight Crew Medical Service Dept., Tokyo, Japan) et al. Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 27, June 1990, p. 35-41. refs

The study aims to clarify the effect of time zone flight on circadian rhythm of plasma cortisol and to investigate the influence of light exposure on the resynchronization. Twelve healthy male volunteers aged 20-26 years underwent an eastward 8 h time shift by jet from Tokyo to San Francisco and spent strictly scheduled 10 days. Control group (n = 6), who lived under the natural sun light condition with more than 10,000 lux for 3 hours in the morning for days two to four showed a recovery of the circadian rhythm of plasma cortisol by day seven. However, the artificial light group (n = 3), who were exposed to 3000 lux fluorescent lamp in a room, and the dim light group (n = 3), who wore eye masks during the same time frame, did not show resynchronization within 10 days. The results indicate that the bright light exposure seems to have some effects on the faster resynchronization of plasma cortisol.

A91-27707* McDonnell-Douglas Space Systems Co., Houston,

IMPLICATIONS OF THE NEW RADIATION EXPOSURE LIMITS ON SPACE STATION FREEDOM CREWS

M. STANFORD (McDonnell Douglas Space Systems Co., Space Station Div., Houston, TX) and D. S. NACHTWEY (NASA, Johnson Space Center, Houston, TX) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1326-1333. refs

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Levels of acceptable risk of radiation exposure for SSF crews have been studied. Since the cancer risk per dose equivalent has increased over the last decade, new dose-equivalent limits have been recommended. An astronaut may not receive more than a depth-dose equivalent of 50 rem/year. It is found that a 180-day stay aboard Freedom could result in a worst case depth-dose of 30 rem, and a 180-day mission in a nominally shielded spacecraft in a constant atmospheric density orbit with a varying altitude could result in a depth-dose equivalent of 10 rem. This is twice the annual allowable dose-equivalent for terrestrial radiation workers. It is noted that the present understanding of the biological effectiveness of high-LET radiation is not adequate for accurate health risk assessments and that further research is necessary. Ò.G.

A91-27962

PREDICTION OF SPACE MOTION SICKNESS SUSCEPTIBILITY BY DISCONJUGATE EYE TORSION IN PARABOLIC FLIGHT

SHIRLEY G. DIAMOND and CHARLES H. MARKHAM (California, University, Los Angeles) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 201-205. refs

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The hypothesis of asymmetric otolith function asserts that physiological or anatomical differences in the two sides of the bilateral gravity-sensing otolith apparatus of the inner ear may be well compensated on earth, but when exposed to novel gravitational states, the prior compensatory stratagems may be ineffective, leading to unstable vestibular responses and causing the phenomenon of space motion sickness. To investigate this hypothesis, spontaneous eye torsion, a reflex governed by the otolith organs, was examined in the upright position during the hypo- and hypergravity of parabolic flight aboard NASA's KC-135 aircraft in nine former astronauts whose history of space motion sickness was revealed after data analysis had been completed. Results showed that astronauts who had been sick in space had significantly higher scores of disconjugate eye torsion in parabolic flight, and that their responses were consistently different in 1.8 G relative to 0 G compared to astronauts who had not been sick in space. In 1 G, there were no difference in disconjugate eye torsion between the subjects. The results support the asymmetry hypothesis and offer a possible predictive test of space motion sickness.

A91-27963* Brandeis Univ., Waltham, MA. DECREASED SUSCEPTIBILITY TO MOTION SICKNESS **DURING EXPOSURE TO VISUAL INVERSION IN MICROGRAVITY**

JAMES R. LACKNER and PAUL DIZIO (Brandeis University, Waltham, MA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 206-211. refs (Contract NAG9-295) Copyright

Head and body movements made in microgravity tend to bring on symptoms of motion sickness. Such head movements, relative to comparable ones made on earth, are accompanied by unusual combinations of semicircular canal and otolith activity owing to the unloading of the otoliths in OG. Head movements also bring on symptoms of motion sickness during exposure to visual inversion (or reversal) on earth because the vestibulo-ocular reflex is rendered anti-compensatory. Here, evidence is presented that susceptibility to motion sickness during exposure to visual inversion is decreased in a 0G relative to 1G force background. This difference in susceptibility appears related to the alteration in otolith function in 0G. Some implications of this finding for the etiology of space motion sickness are described. Author

A91-27965

MARIJUANA CARRY-OVER EFFECTS ON AIRCRAFT PILOT **PERFORMANCE**

VON O. LEIRER (Decision Systems, Stanford, CA), JEROME A. YESAVAGE, and DANIEL G. MORROW (Stanford University, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562). vol. 62, March 1991, p. 221-227. refs

(Contract NIH-DA-03593; NIH-2-R44-AG-06957-02) Copyright

This study finds evidence for 24-h carry-over effects of a moderate social dose of marijuana on a piloting task. In separate sessions, nine currently active pilots smoked one cigarette containing 20 mg of delta 9 THC and one Placebo cigarette. Using an aircraft simulator, pilots flew just before smoking, and 0.25, 4, 8, 24, and 48 h after smoking. Marijuana impaired performance at 0.25, 4, 8, and 24 h after smoking. While seven of the nine pilots showed some degree of impairment at 24 h after smoking, only one reported any awareness of the drug's effects. The results suggest that very complex human/machine performance can be impaired as long as 24 h after smoking a moderate social dose of marijuana, and that the user may be unaware of the drug's influence. Author

A91-27966

EFFECT OF HYPOXIA ON PSYCHOMOTOR PERFORMANCE **DURING GRADED EXERCISE**

DOUGLAS R. KNIGHT, CHRISTINE SCHLICHTING, JAMES H. DOUGHERTY, ARTHUR A. MESSIER (U.S. Navy, Naval Submarine Medical Research Laboratory, Groton, CT), and DONALD V. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 228-232. Navy-supported research. refs

Copyright

The combined effects of reduced O2 (12 percent) and graded ergometer exercise (10, 70, and 140 W) on the performance of a psychomotor task are studied. Six men participated in two test sessions each. Each session began with the baseline data (air) and finished with exposure data (12 or 21 percent, random, unidentified). The psychomotor task score was degraded during the 140-W work rate in the 12-percent O2 condition (p less than 0.05). Reductions of the Sa(O2) (p less than 0.05) at each work

rate proved that hypoxia existed during exercise in the 12-percent O2 condition.

A91-27967* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

EFFECTS OF ALCOHOL ON PILOT PERFORMANCE IN SIMULATED FLIGHT

C. E. BILLINGS, T. DEMOSTHENES, T. R. WHITE, and D. B. O'HARA (NASA, Ames Research Center, Moffett Field, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 233-235.

Copyright

Ethyl alcohol's known ability to produce reliable decrements in pilot performance was used in a study designed to evaluate objective methods for assessing pilot performance. Four air carrier pilot volunteers were studied during eight simulated flights in a B727 simulator. Total errors increased linearly and significantly with increasing blood alcohol. Planning and performance errors, procedural errors and failures of vigilance each increased significantly in one or more pilots and in the group as a whole.

Author

A91-27968

RELATIONSHIPS OF ANXIETY SCORES TO SCREENING AND TRAINING STATUS OF AIR TRAFFIC CONTROLLERS

WILLIAM E. COLLINS, DAVID J. SCHROEDER, and LENDELL G. NYE (FAA, Aeromedical Institute, Oklahoma City, OK) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 236-240. refs

The present study assessed the relationship between anxiety, as measured by the state-trait personality inventory (STPI), and success of post-strike air traffic control specialist (ATCS) trainees at the FAA Academy and during field training. Results support the operation of some personality-related self-selection among ATCS applicants regarding anxiety and the importance of the low anxiety characteristic for ATCS job success.

A91-27969

EFFECTS OF WATER TEMPERATURE ON PERFORMANCE - A PRACTICAL EVALUATION OF A NEUTRAL BUOYANCY FACILITY

GRETA BOLSTAD, EIRIK MYRSETH, BARD HOLAND, and ARVID PASCHE (Foundation for Scientific and Industrial Research, Trondheim, Norway) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 241-245. ESA-supported research. refs

Copyright

Manual and cognitive performance of two female and four male divers was evaluated in 'cold' and 'warm' water in a neutral buoyancy facility. A test battery of six manual and cognitive tests was applied in a fixed sequence in three separate, 3-h dives: (1) water temperature 18-19 C, wet suit 3-5 mm thick, (2) water temperature 32-33 C, bathing suit and T-shirt, and (3) water temperature 18-19 C, tailor made wet suit 6.5 mm thick. No significant differences in performance between the three conditions were recorded. Mean rectal temperature decreased by 1 C in all dive conditions, except in females in dive 2. Ventilation was significantly higher in dive 1 than in dives 2 and 3. Thermal discomfort was reported only after 2 h in dive 1. It is suggested that support divers may work safely, comfortably, and effectively for at least 2 h in water of 18-19 C, if dressed in thermal protective wet suits.

A91-27970 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

POSTURAL RESPONSES OF HEAD AND FOOT CUTANEOUS MICROVASCULAR FLOW AND THEIR SENSITIVITY TO BED REST

MICHAEL ARATOW, ALAN R. HARGENS, J.-UWE MEYER, and SARA B. ARNAUD (NASA, Ames Research Center, Moffett Field, CA) Aviation, Space, and Environmental Medicine (ISSN

0095-6562), vol. 62, March 1991, p. 246-251. NASA-supported research. refs Copyright

To explore the mechanism for facial puffiness, headache, and nasal congestion associated with microgravity and cephalad fluid shifts, the postural responses of the cutaneous microcirculation (CMC) in the forehead and dorsum of the foot of eight healthy men were studied by changing body position on a tilt table and measuring blood flows with a laser Doppler flowmeter. Increasing arterial pressure in the feet by moving from a -6-deg head-down tilt to a 60-deg head-up posture decreased foot CMC by 46.5 + or - 12.0 percent. Raising arterial pressure in the head increased forehead CMC by 25.5 \pm or - 0.7 percent (p less than 0.05). To investigate the possibility that these opposite responses could be modified by simulated microgravity, tilt test were repeated after 7 d of -6-deg head-down-tilt bed rest. The responses were not significantly different from those recorded before bed rest. Therefore, CMC in the feet is well regulated to prevent edema when shifting to an upright position, whereas there is less regulation in the head CMC.

A91-27971

STEADY STATE AND TRANSIENT G-EXCESS EFFECTS

FRED E. GUEDRY and ANGUS H. RUPERT (U.S. Navy, Naval Aerospace Research Laboratory, Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 252, 253. refs
Copyright

Acceleration forces of flight are associated with a number of spatial orientation illusory effects. This note focuses on two effects, both called the 'G-excess effect'. A distinction between steady-state and transient G-excess effects is important because prescriptions for preventive management of effects in flight will differ. Author

A91-27972 REDUCED CONTRAST SENSITIVITY WHEN VIEWING THROUGH AN AIRCRAFT WINDSCREEN

PHILIP K. HUGHES (Department of Defence, Aeronautical Research Laboratory, Melbourne, Australia) and ALGIS J. VINGRYS (Melbourne, University, Parkville, Australia) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 254-257. refs
Copyright

The contrast sensitivity function (CSF) of an experienced observer was measured under normal viewing conditions, when looking through an aircraft windscreen and when looking through the windscreen in the presence of a glare source. It is found that contrast sensitivity was significantly reduced for frequencies above about 6 cycles/degree viewed through the windscreen and that the addition of a glare source further reduced contrast sensitivity for all spatial frequencies greater than 1 cycle/degree. These results demonstrate that the CSF is a sensitive metric of degraded visual performance when viewing through optical transparencies.

Author

A91-27974 ERRORS IN MEASUREMENT OF +GZ ACCELERATION

TOLERANCE

DAVID A. LUDWIG (North Carolina, University, Greensboro) and LARRY P. KROCK (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 261-265. USAF-supported research. refs

Most acceleration studies estimate a subject's G-level tolerance by taking only one determination (test) for a given condition. The purpose of this study was to examine the error structure and reliability of an individual's acceleration tolerance and to provide design considerations for future experimentation. A hierarchical (nested) design was used to estimate the sources of variation in measuring G-level tolerance. Six males rode relaxed in the USAF School of Aerospace Medicine human-use centrifuge and were exposed to a 0.1 G/s onset rate profile until greyout. Each subject

was tested on three randomly selected days with three repeated determinations within a day. This design allowed for an estimate of both day-to-day and measurement error within a testing session. A single +Gz tolerance determination was found to be moderately unreliable (reliability coefficient = 0.74). Under the best of circumstances a subject's G-level tolerance cannot be estimated with any more accuracy than about + or - 0.3 G with 95 percent confidence. This degree of accuracy can only be obtained with multiple measurements.

A91-27975

THE USE OF THE PRESSURE CUFF TEST IN THE DIAGNOSIS OF DECOMPRESSION SICKNESS

FREDERICK W. RUDGE and JEFFREY A. STONE (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, March 1991, p. 266, 267. refs

Copyright

Records at the Hyperbaric Medicine Division, United States Air Force School of Aerospace Medicine, were reviewed to determine the utility of the pressure cuff test as an aid in the diagnosis of Type I decompression sickness (DCS). Applying local pressure with a blood pressure cuff has been described as a useful test to differentiate the pain of DCS from that of other musculoskeletal conditions. Records were reviewed from January 1985 to December 1989. During this period 179 patients were treated with recompression for extremity pain. Application of a blood pressure cuff to the painful area was used as a diagnostic aid in 87 patients. Only 53 patients (61 percent) with DCS had a positive test (relief of pain with local pressure). Results did not correlate with the rapidity of relief of symptoms during recompression. It is concluded that the failure to respond to the application of local pressure should not be used to rule out the presence of DCS - this must be done with a test of pressure in a hyperbaric chamber. Author

A91-28163* Toronto Univ. (Ontario). COMPARISON OF SMOOTH PURSUIT AND COMBINED EYE-HEAD TRACKING IN HUMAN SUBJECTS WITH DEFICIENT LABYRINTHINE FUNCTION

R. J. LEIGH, S. E. THURSTON (Cleveland, University Hospitals; USVA, Medical Center, OH), J. A. SHARPE, P. J. RANALLI (Toronto Western Hospital, Canada), and M. A. HAMID (Cleveland Clinic Foundation, OH) Experimental Brain Research (ISSN 0014-4819), vol. 66, 1987, p. 458-464. Research supported by USVA, Evenor Armington Fund, Toronto Western Hospital, and Medical Research Council of Canada. refs

(Contract NIH-EY-06717; NAS9-17439)

Copyright

The effects of deficient labyrinthine function on smooth visual tracking with the eyes and head were investigated, using ten patients with bilateral peripheral vestibular disease and ten normal controls. Active, combined eye-head tracking (EHT) was significantly better in patients than smooth pursuit with the eyes alone, whereas normal subjects pursued equally well in both cases. Compensatory eye movements during active head rotation in darkness were always less in patients than in normal subjects. These data were used to examine current hypotheses that postulate central cancellation of the vestibulo-ocular reflex (VOR) during EHT. A model that proposes summation of an integral smooth pursuit command and VOR/compensatory eye movements is consistent with the findings. Observation of passive EHT (visual fixation of a head-fixed target during en bloc rotation) appears to indicate that in this mode parametric gain changes contribute to modulation of the VOR.

A91-28164* Akron Univ., OH. FREQUENCY AND VELOCITY OF ROTATIONAL HEAD PERTURBATIONS DURING LOCOMOTION

G. E. GROSSMAN, R. J. LEIGH, D. J. LANSKA, S. E. THURSTON (Cleveland, University Hospitals; USVA, Medical Center, OH), and L. A. ABEL (Akron, University, OH) Experimental Brain Research (ISSN 0014-4819), vol. 70, 1988, p. 470-476. Research supported

by USVA and Evenor Armington Fund. refs (Contract PHS-EY-00288; PHS-EY-06717; NAS9-17439) Copyright

The magnetic searth coil technique was used to record horizontal (yaw) and vertical (pitch) head rotations of 20 normal subjects during walking in place, running in place, vigorous voluntary horizontal head rotation, and vigorous voluntary vertical head rotation. Data are presented to show that (1) during locomotion, the head is stabilized in space incompletely but adequately so that the vestibuloocular reflex (VOR) is not saturated; (2) durign vigorous, voluntary head rotations, the maximum head velocity exceeds the range where the VOR can stabilize gaze; and (3) the frequencies of head rotations that occur during locomotion greatly exceed frequencies conventionally used in the laboratory for testing the VOR.

A91-28170*

BEHAVIOR OF HUMAN HORIZONTAL VESTIBULO-OCULAR REFLEX IN RESPONSE TO HIGH-ACCELERATION STIMULI

E. F. MAAS, W. P. HUEBNER, S. H. SEIDMAN, and R. J. LEIGH (Cleveland, University Hospitals; USVA, Medical Center, OH) Brain Research (ISSN 0006-8993), vol. 499, 1989, p. 153-156. Research supported by USVA and Evenor Armington Fund. refs (Contract NIH-EY-06717; NAS9-17439)

The horizontal vestibulo-ocular reflex (VOR) during transient, high-acceleration (1900-7100 deg/sec-squared) head rotations was studied in four human subjects. Such stimuli perturbed the angle of gaze and caused illusory movement of a viewed target (oscillopsia). The disturbance of gaze could be attributed to the latency of the VOR (which ranged from 6-15 ms) and inadequate compensatory eye rotations (median VOR gain ranged from 0.61-0.83).

N91-17533# Texas Univ. Health Science Center, Houston. School of Public Health.

HYPERBARIC OXYGENATION (HBO) CLINICAL TRIALS: A REVIEW M.S. Thesis

JAMES ROY KNOWLES May 1990 48 p Sponsored by AFIT, Wright-Patterson AFB, OH

(AD-A227901; AFIT/CI/CIA-90-097) Avail: NTIS HC/MF A03 CSCL 06/5

Hyperbaric oxygenation (HBO) has been used as a medical intervention for the treatment or prophylaxis of numerous conditions in humans. There is an accumulation of pre-clinical and clinical data supporting its use in humans. It has been asserted that the clinical data are largely derived from anecdotal, uncontrolled observations. The call for reliable data from good clinical trials has sounded forth both from within and from outside the HBO community. A logical question is: What clinical trials have actually been done to assess the efficacy of HBO, how good were they, and what did they find. This thesis will present a review of HBO clinical trials which will help answer the above question. The review will identify HBO clinical trials in the general medical literature, assess their methodologic content, and list the reported efficacy of HBO in the various trials. Lastly, the review will briefly discuss its findings as they relate to future clinical research involving the use of HBO.

N91-17534# Naval Medical Research Inst., Bethesda, MD. EFFECTS OF MULTIPLE COLD AIR EXPOSURES ON DELAYED MATCHING TO SAMPLE PERFORMANCE Interim Report

DAVID W. ARMSTRONG and JOHN R. THOMAS 2 Apr. 1990 19 p (AD-A228390; NMRI-90-87) Avail: NTIS HC/MF A03 CSCL

(AD-A228390; NMH-90-87) AVAII: NTIS HC/MF A03 CS 06/10

Acute exposure to moderate cold impairs delayed matching to sample (DMS) performance in both animal and man. The effect of multiple cold air (2.6 + or - 0.6 C) exposures on DMS performance was investigated. Twelve men performed the DMS task during a 45 min exposure to cold air on Day 1. Oxygen consumption (VO2) was measured concurrently. After completion

of Day 1, subjects were assigned to two groups, Group W performed the DMS task on Days 2 to 11 in warm air (22 C) during a 45 min period before sitting in cold air for 45 min. Group C performed the DMS task during a 45 min exposure to cold air on days 2 to 11. On Day 12, all subjects were exposed to cold air as on Day 1. VO2 was measured concurrently on Days 4 to 8. DMS performance was significantly impaired in all subjects during exposure to cold air on Day 1 when compared to baseline DMS performance. Performance on the DMS was significantly different between the groups on Day 12. Group W performance was not different on Day 12 when compared to Day 1. Group C performance was not different from baseline on Day 12 and was significantly improved when compared to Day 1. VO2 was elevated in the cold but was not different between groups. VO2 was not different on Day 12 when compared to Day 1. DMS is affected by acute exposure to cold air. Performance on the DMS task improves with repeated cold air exposure only when the DMS task is repeatedly performed in cold air.

N91-17535# Institute for Defense Analyses, Alexandria, VA. FLYING HOURS AND AIRCREW PERFORMANCE Final Report, Jul. 1987 - Dec. 1989

COLIN P. HAMMON and STANLEY A. HOROWITZ Mar. 1990

39 p

(Contract MDA903-84-C-0031)

(AD-A228582; AD-E501304; IDA-P-2379; IDA/HQ-90-35201)

Avail: NTIS HC/MF A03 CSCL 05/9

This work addresses the development of quantitative relationships between how much aircrews have flown and how well they perform important aspects of their missions. It is determined that additional flying enhances proficiency in two ways: through the short-run honing of skills and through the long-run development of mastery. Estimates of the strength of the links between flying experience and three measures of performance are developed. The measures are: bombing accuracy, the quality of landings aboard aircraft carriers, and kills in air combat maneuvering exercises. In general, it is found that while both short-run experience are important, career experience has a stronger relationship than recent experience to performance.

GRA

N91-17536# National Inst. of Standards and Technology, Gaithersburg, MD.

FED-X: THE NIST EXPRESS TRANSLATOR

STEPHEN NOWLAND CLARK Aug. 1990 18 p (PB90-269507; NISTIR-4371) Avail: NTIS HC/MF A03 CSCL 08/2

The product data exchange specification (PDES) is an emerging standard for the exchange of product information among various manufacturing applications. PDES includes an information model written in the Express language; other PDES-related information models are also written in Express. The National PDES Testbed and NIST has developed software to manipulate and translate Express models. The software consists of an in-memory working form and an associated Express language parser, FED-X. The design and capabilities of FED-X and the Express Working Form are discussed.

N91-17537# Pacific Northwest Lab., Richland, WA. ELF (EXTREMELY-LOW-FREQUENCY) FIELD INTERACTIONS AT THE ANIMAL, TISSUE AND CELLULAR LEVELS

T. S. TENFORDE Oct. 1990 22 p Presented at the 10th Anniversary Meeting of the Bioelectrical Growth and Repair Society, Philadelphia, PA, 14-16 Oct. 1990 (Contract DE-AC06-76RL-01830)

(DE91-004807; PNL-SA-18664; CONF-9010265-1) Avail: NTIS HC/MF A03

A description is given of the fundamental physical properties of extremely-low-frequency (ELF) electromagnetic fields, and the mechanisms through which these fields interact with the human body at a macroscopic level. Biological responses to ELF fields at the tissue, cellular and molecular levels are summarized,

including new evidence that ELF field exposure produces alterations in gene expression and the cytoplasmic concentrations of specific proteins.

N91-17538*# Texas Univ., Galveston. Dept. of Otolaryngology, Physiology and Biophysics.

INVESTIGATION OF OTOLITH RESPONSES USING GROUND BASED VESTIBULAR RESEARCH FACILITY Final Technical Report, 2 Jul. 1982 - 30 Jun. 1989

MANNING J. CORREIA and TABARACCI 30 Jun. 1989 8 p. (Contract NAG2-186)

(NASA-CR-187877; NAS 1.26:187877) Avail: NTIS HC/MF A02 CSCL 06/16

The general goal was to examine tilt sensitivity of horizontal semicircular canal afferents. Computer programs were tested which controlled the short axis centrifuge at the Vestibular Research Facility, acquired action potentials and produced data reduction analyses including histograms and gain and phase calculations. A pre-amplifier was also developed for the acquisition of action potentials. The data were gathered that can be used to contribute toward the understanding of the tilt sensitivity of semicircular canal afferents in the unanesthetized gerbil preparation.

N91-17539# Naval Biodynamics Lab., New Orleans, LA. BIBLIOGRAPHY OF SCIENTIFIC PUBLICATIONS OF THE NAVAL BIODYNAMICS LABORATORY: 1980-1990 Interim

Report, 1 Jan. 1980 - 31 Aug. 1990 4 Sep. 1990 27 p Sponsored by Naval Medical Research and Development Command, Bethesda, MD

(AD-A229030; NBDL-90R005) Avail: NTIS HC/MF A03 CSCL 06/5

This report lists all research reports, special reports, monographs, technical memoranda, joint reports, research information bulletins, journal articles, and conference proceedings published by the Naval Biodynamics Laboratory between January 1980 and August 1990.

N91-17540# Dartmouth Coll., Hanover, NH. Dept. of Psychology.

MULTIMODAL INTERACTIONS IN SENSORY-MOTOR PROCESSING Annual Technical Report, Jul. 1989 - Jul. 1990 H. C. HUGHES, P. A. REUTER-LORENZ, R. FENDRICH, G. NOZAWA, and M. S. GAZZANIGA 15 Sep. 1990 91 p (Contract AF-AFOSR-0437-89; AF PROJ. 2313) (AD-A229111; AFOSR-90-1132TR) Avail: NTIS HC/MF A05 **CSCL 06/5**

The saccadic control system represents a good model system to study the selection of stimulus events according to their spatial location. The present work focuses on two factors known to influence saccade latency: the presence of a fixation stimulus and the nature of the saccade target. We report evidence which suggests that fixation point offsets facilitate pre-motor stages of saccade generation (Reuter-Lorenz et al., in press; Appendix I). This idea, in conjunction with electrophysiological data, suggested that fixation offset might also facilitate saccades to acoustic targets. Experiment 1 confirmed this suggestion (Fendrich, et al. (in preparation)). The facilitatory effects of redundant stimulation via the visual and auditory modalities is examined in Experiment 2 (Nozawa et al., 1990). The data suggest significant neural summation, which we attribute to bimodal convergence onto individual cells though to mediate saccadic command functions.

N91-17541# Texas Univ. Health Science Center, San Antonio. Dept. of Ophthalmology.

GLARE AND AGE: ACQUISITION OF A CLINICAL DATA BASE FOR AIRCREW STANDARDS Final Report, Feb. 1988 - Jun.

JOSEPH M. HARRISON, CHEN PENG, CHARLES S. BALLENTINE. and J. TERRY YATES Oct. 1990 44 p Sponsored by Southeastern Center for Electrical Engineering Education, Inc., Saint Cloud, FL

(Contract F33615-87-D-0609; AF PROJ. 7755) (AD-A229237; USAFSAM-TR-90-28) Avail: NTIS HC/MF A03 CSCI 06/4

The trend towards a significant age-related decline in contrast sensitivity that was demonstrated in subjects aged 21 to 50 in previous studies prompted a replication with a large sample size and an investigation of scattered light, measured indirectly by disability glare, as a function of age. The age related decline of contrast sensitivity was unconfirmed in the age range 21 to 50 with a large sample size, 30, in each decade. Contrast sensitivity to neither externally generated nor interference gratings changed significantly with age. The high spatial frequency cutoff derived from the contrast sensitivity to 12, 16, and 20 cycle per degree gratings did not vary as a function of age. This is consistent with the fact that we selected only those subjects with 20/20 or better visual acuity. Consistent with the lack of declining contrast sensitivity over this age range was the lack of a significant age-related increase in susceptibility to disability glare as measured by sensitivity to 4 and 12 cycles per degree gratings without and with glare. The interaction between age and glare condition was not statistically significant. Increment threshold for a low mesopic background did not change significantly as a function of age. There was a significant increase in the increment threshold limited ot the glare condition for the oldest decade in the paradigm simulating night time glare.

N91-18572# California Univ., Berkeley. Lawrence Berkeley Lab.

DIGITAL RADIOGRAPHY: PRESENT DETECTORS AND FUTURE DEVELOPMENTS

V. PEREZ-MENDEZ Aug. 1990 20 p Presented at the 3rd International Conference on Applications of Physics in Medicine and Biology: Medical Diagnostic Imaging, Trieste, Italy, 4-7 Sep. 1990

(Contract DE-AC03-76SF-00098)

(DE91-005386; LBL-29441; CONF-900993-1) Avail: NTIS

Present detectors for digital radiography are of two classes: real time detectors and storage (non real time) types. Present real time detectors consist of image intensifier tubes with an internal cesium iodide layer x ray converter. Non real time detectors involve linear sweep arrays or storage detectors such as film. Future detectors discussed here can be of both types utilizing new technologies such as hydrogenated amorphous silicon photodiode arrays coupled to thin film transistor arrays.

N91-18573*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

MICROBIOLOGY ON SPACE STATION FREEDOM

DUANE L. PIERSON, ed., MICHAEL R. MCGINNIS, ed., S. K. MISHRA, ed., and CHRISTINE F. WOGAN, ed. (Krug International, Houston, TX.) Washington Feb. 1991 40 p Conference houston, TX, 6-8 Nov. 1989

(NASA-CP-3108; S-619; NAS 1.55:3108) Avail: NTIS HC/MF A03 CSCL 06/3

This panel discussion convened in Houston, Texas, at the Lunar and Planetary Institute, on November 6 to 8, 1989, to review NASA's plans for microbiology on Space Station Freedom. A panel of distinguished scientists reviewed, validated, and recommended revisions to NASA's proposed acceptability standards for air, water, and internal surfaces on board Freedom. Also reviewed were the proposed microbiology capabilities and monitoring plan, disinfection procedures, waste management, and clinical issues. In the opinion of this advisory panel, ensuring the health of the Freedom's crews requires a strong goal-oriented research effort to determine the potential effects of microorganisms on the crewmembers and on the physical environment of the station. Because there are very few data addressing the fundamental question of how microgravity influences microbial function, the panel recommended establishing a ground-based microbial model of Freedom, with subsequent evaluation using in-flight shuttle data. Sampling techniques and standards will be affected by both technological advances in

microgravity-compatible instrumentation, and by changes in the microbial population over the life of the station.

N91-18574# Joint Publications Research Service, Arlington, VA. JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE SCIENCES

2 Oct. 1990 54 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-90-016) Avail: NTIS HC/MF A04

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: aerospace medicine, epidemiology, immunology, microbiology, nonionizing radiation effects, physiology, radiobiology, and virology.

N91-18575# Joint Publications Research Service, Arlington, VA. ORTHOSTATIC STABILITY OF ATHLETES OF DIFFERENT SPECIALIZATIONS AND ITS CHANGE AS PRODUCED BY LOWER GRAVITY Abstract Only

S. V. DRONENKO *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 1 2 Oct. 1990 Transl. into ENGLISH from Voyenno-Meditsinskiy Zhurnal, no. 5, May 1989 p 62 Avail: NTIS HC/MF A04

The orthostatic stability of athletes of different specializations was examined, and the changes in that stability after a stint under conditions of lower gravity are discussed. The conditions of reduced gravity were simulated by submersion into a dry immersion for three days. During the orthostatic test and during the recovery period, the following indicators of central and peripheral hemodynamics were determined: stroke volume, pulse blood flow of the fermur and crus (by the rheographic method), heart contraction rate (from ECG), and systolic and diastolic blood pressure.

N91-18576# Joint Publications Research Service, Arlington, VA. POSSIBILITY OF USING EVOKED BRAIN POTENTIALS TO DIAGNOSE FLIGHT CREW FATIGUE

V. A. PONOMARENKO, S. V. YEGOROV, and O. V. ZHERNAVKOV In its JPRS Report: Science and Technology. USSR: Life Sciences p 1-3 2 Oct. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 23, no. 4, Jul.-Aug. 1989 p 21-23 Avail: NTIS HC/MF A04

The possibilities for using evoked potentials to diagnose fatigue among flight crews when they are performing their jobs are studied. The basic theoretical premise was the accepted fact that as fatigue develops, the physiological price of activity increases, reserve possibilities for processing additional information decline, and performance of a flying assignment worsens in the dynamics of pilot performance. A 10-hour flight on a route with alternating cycles of manual and automatic control was modeled on a flight simulator. An electroencephalogram was recorded during the landing approaches. Auditory stimuli irrelevant to the operator were used to obtain auditory evoked potentials (AEPs). Traditional indicators were used in the analysis of average AEPs - the latent periods of isolated components and their amplitudes. Before and after the experiment the operator used a special scale to evaluate the level of their feeling of fatigue. The quality of activity associated with the landing approach was evaluated.

N91-18578# Joint Publications Research Service, Arlington, VA. THE MECHANISM OF THE DRUG RESISTANCE OF ESCHERICHIA IN COSMONAUTS

V. K. ILIN In its JPRS Report: Science and Technology. USSR: Life Sciences p 7-9 2 Oct. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 23, no. 4, Jul.-Aug. 1989 p 90-91 Avail: NTIS HC/MF A04

The risk of falling ill to infectious diseases grows significantly among people in biological isolation. This shows up in the activation of the conditionally pathogenic component of human automicroflora, the weakening of the colonization resistance barrier, and the weakening of the immune system. Intensive microbial exchange occurs between people occupying hermetically sealed

spaces. The molecular epidemiological features of changes in drug resistance to Escherichia isolated from the intestines of cosmonauts during space flight and from subjects participating in a 30-day simulation study were examined.

N91-18579# Joint Publications Research Service, Arlington, VA. JPRS REPORT: SCIENCE AND TECHNOLOGY, USSR: LIFE **SCIENCES**

26 Sep. 1990 71 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-90-015) Avail: NTIS HC/MF A04

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: biochemistry, biotechnology, epidemiology, immunology, medicine, nonionizing radiation effects, pharmacology and toxicology, physiology, public health, and virology.

N91-18580# Joint Publications Research Service, Arlington, VA. PHARMACOLOGICAL REGULATION OF PHYSIOLOGICAL **FUNCTIONS IN SPACE MEDICINE**

V. S. SHASKHOV In its JPRS Report: Science and Technology. USSR: Life Sciences p 1-5 26 Sep. 1990 Transl. into ENGLISH from Farmakologiya i Toksikologiya, Moscow (USSR), v. 53, no. 1. Jan.-Feb. 1990 p 5-10

Avail: NTIS HC/MF A04

The body's physiological systems that are most sensitive to the effects of weightlessness and subject to pharmacological adjustment at various stages of space flight are examined. Special attention is given to the design and practical application of cardiovascular preparations, and agents for the prevention of motion sickness, as well as substances that affect metabolic processes and mineral saturation of bone tissue. Emphasis is given to the possible use of medical agents in space flights and in practical public health.

N91-18581# Joint Publications Research Service, Arlington, VA. EFFECT OF GRADED PHYSICAL STRESS ON CEREBRAL **HEMODYNAMICS IN PILOTS Abstract Only**

L. I. STARIKOV In its JPRS Report: Science and Technology. USSR: Life Sciences p 6 26 Sep. 1990 Transl. into ENGLISH from Vovenno-Meditsinskiv Zhurnal, Moscow (USSR), no. 6, Jun. 1989 p 45-49

Avail: NTIS HC/MF A04

An analysis was conducted in the effects of graded physical stress on cerebral hemodynamics in order to refine fitness parameters for pilots. It is shown that, in general, individuals with cardiovascular problems generally presented with hypo- or hyperperfusion of the brain and much greater recovery periods. These are factors that have to be considered in assessing job fitness and in planning flight assignments to avoid undue physical stress. A program of exercise therapy recommended for pilots with hypo- and hyperdynamic extrasystoles is discussed.

N91-18583# Joint Publications Research Service, Arlington, VA. JPRS REPORT: SCIENCE AND TECHNOLOGY. USSR: LIFE **SCIENCES**

14 Sep. 1990 54 p Transl. into ENGLISH from various Russian articles

(JPRS-ULS-90-014) Avail: NTIS HC/MF A04

Abstracts of Soviet literature in various areas of the life sciences are compiled. The following subject areas are covered: aerospace medicine, biotechnology, epidemiology, medicine, microbiology, molecular biology, nonionizing radiation effects, pharmacology and toxicology, physiology, public health, radiobiology, and virology.

N91-18584# Joint Publications Research Service, Arlington, VA. CEREBRAL-VASCULAR EFFECTS OF MOTION SICKNESS **Abstract Only**

YU. YE. MOSKALENKO, A. I. BEKETOV, V. F. MAKSIMUK, and N. A. SKOROMNYY In its JPRS Report: Science and Technology. USSR: Life Sciences p 1 14 Sep. 1990 Transl. into ENGLISH from Fiziologicheskiy Zhurnal SSSR imeni I. M. Sechenova.

Leningrad (USSR), v. 75, no. 11, Nov. 1989 p 1560-1567 Avail: NTIS HC/MF A04

Cerebral-vascular effects of motion sickness may be expressed not only and not so much in changes of the level of blood supply to the brain as in direct responses to such an effect, predominantly in changes of capacities of the cerebral blood circulation systems to adapt to external effects accompanying motion sickness as the result of reconstruction of neurodynamic processes under its effect. At the same time, changes of activity of the neurogenic component in the mechanism of regulation of cerebral blood circulation may affect not only qualitative indicators of this process but also the state of the water balance of the brain tissue if, against the background of motion sickness, a change of conditions of blood flow from the brain occurs.

N91-18585# Joint Publications Research Service, Arlington, VA. CENTRAL AND SYSTEMIC HEMODYNAMICS IN SIMULATED **WEIGHTLESSNESS Abstract Only**

R. T. KAZAKOVA and V. P. KATUNTSEV In its JPRS Report: Science and Technology. USSR: Life Sciences p 1-2 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 24, no. 1, Jan. - Feb. 1990 p 15-17

Avail: NTIS HC/MF A04

Central and systemic hemodynamics were assessed in healthy males subjected to simulated weightlessness, which was simulated by water immersion during daytime and -10 C antiorthostasis at night. The resultant monitoring studies demonstrated pronounced time-related hemodynamic shifts. The diminished venous return seen in every subject was interpreted to represent adaptive changes to blood volume redistribution. The mechanism involved the effects of excessive intrathoracic blood volumes on cardiac and vascular volume receptors, activation of which serves to enhance diuresis. As a result, the diastolic end volume falls by approximately 25 percent, a phenomenon that also appears as one of the first manifestations of cardiovascular decompensation in cosmonauts.

N91-18586# Joint Publications Research Service, Arlington, VA. RELATIONSHIP BETWEEN ORTHOSTATIC STABILITY AND POST-SPACE FLIGHT VESTIBULAR FUNCTION IN MAN **Abstract Only**

V. M. MIKHAYLOV, L. N. KORNILOVA, A. F. ZHERNAKOV, A. D. VOSKRESENSKIY, YU. D. POMETOV, and V. N. ALEKSEYEV In its JPRS Report: Science and Technology, USSR: Life Sciences 14 Sep. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 24. no. 1, Jan.-Feb. 1990 p 49-50

Avail: NTIS HC/MF A04

Analysis of the relationship between orthostatic stability and vestibular function was performed on cosmonauts after space flight abroad the Salyut-6 space station. Orthostatic and vestibular function tests conducted upon landing and later showed functional deterioration in both tests. In addition, a positive correlation coefficient was obtained for centered results of both tests.

Author

N91-18587# Joint Publications Research Service, Arlington, VA. RELATIONSHIP BETWEEN VERTICAL OPTOKINETIC NYSTAGMUS AND SUSCEPTIBILITY TO MOTION SICKNESS **Abstract Only**

O. A. VOROBYEV, V. V. ZARITSKAYA, and YU. V. KRYLOV In its JPRS Report: Science and Technology. USSR: Life Sciences 14 Sep. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 24, no. 1, Jan.-Feb. 1990 p 50-52

Avail: NTIS HC/MF A04

A study was conducted on the relationship between vertical optokinetic nystagmus and motion sickness on healthy males under conditions of simulated weightlessness. The data demonstrated that factors affecting the vestibular apparatus (primarily optolithic receptors) and redistribution of body fluids in the cranial direction modify vertical optokinetic nystagmus to a much greater degree in subjects who are susceptible to motion sickness. These findings confirmed the importance of hemodynamics in the pathogenesis of motion sickness, as well as the fact that studies on vertical optokinetic nystagmus, particularly of downward predominance, may be of prognostic value regarding susceptibility to motion sickness during space flight.

Author

N91-18589# Joint Publications Research Service, Arlington, VA. CIRCADIAN PATTERNS IN PLASMA LIPIDS, CARBOHYDRATES, AND SOME HORMONES OF HEALTHY PILOTS Abstract Only

YE. YE. NIKOLAYEVSKIY In its JPRS Report: Science and Technology. USSR: Life Sciences p 3 14 Sep. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 24, no. 2, Mar.-Apr. 1990 p 21-23 Avail: NTIS HC/MF A04

A comparative analysis was conducted on the circadian patterns of plasma lipids, hormones, and blood sugar in healthy pilots and an age- and health-equivalent group of non-flight specialists. The results demonstrated that the mean daily lipid and hormone levels in the pilots exceeded the corresponding control levels, usually by a factor of one-fold or better. In the case of blood sugar the relationship was reversed, with the level in the control subjects exceeding the value in pilots. Differences between the two groups were also noted in acrophase values and amplitude parameters. The most pronounced differences in acrophase were noted for blood sugar, beta-lipoproteins, and cholesterol. In general, the shifts were interpreted to reflect pilot adaptability in the face of stress, with the conclusion that these biochemical values may be used in assessment of occupational fitness.

N91-18590# Joint Publications Research Service, Arlington, VA. EXPERIMENTAL ASSESSMENT OF EFFECT OF HEAD POSITION ON CENTER OF GRAVITY OF HUMAN BODY IN EJECTIONS SEATS Abstract Only

G. G. DEMIRCHOGLYAN, YU. G. KONAKHEVICH, V. KH. PETLYUK, R. V. PESHKOV, P. N. KHLOMENOK, L. N. SHOLPO, and V. I. BRAZHNIK *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 3 14 Sep. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 24, no. 2, Mar.-Apr. 1990 p 24-25 Avail: NTIS HC/MF A04

Kinematic experiments were performed on 55 pilots to assess the effects of head inclination on the body's center of gravity in ejection seats. The purpose was to obtain quantitative data relating trajectory of the ejection seats in relation to anthropometric characteristics, employing a dynamographic stand designed to measure such effects. A two-factor regression equation relating head inclination to change in the center of gravity was derived and used for graph construction.

N91-18591# Joint Publications Research Service, Arlington, VA. ULTRASONIC ASSESSMENT OF HUMAN TIBIA DURING 370-DAY ANTIORTHOSTATIC HYPOKINESIA Abstract Only

A. M. TATARINOV, S. L. DUBONOS, KH. A. YANSON, V. S. OGANOV, V. V. DZENIS, and A. S. RAKHMANOV *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 3 14 Sep. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 24, no. 2 Mar.-Apr. 1990 p 29-31

Avail: NTIS HC/MF A04

Studies were conducted on ultrasonic assessment of the effects of simulated weightlessness and exercise therapy on human long bones. The subject were maintained in an antiorthostatic position. Exercise therapy was constant throughout the experiment for some subjects, and for other ones it was started at the beginning of the fifth month. Acoustic profiles for 120 kHz waves revealed considerable individual variations in average velocity, average velocity in the diaphyses, and decrement values in velocity along the distal half of tibia. One year after the experiment all values returned to baseline levels, and the resultant data confirmed the beneficial effects of exercise on human long bones in simulated weightlessness.

N91-18592# Joint Publications Research Service, Arlington, VA. STRESS AND HUMAN CIRCULATION Abstract Only

B. M. FEDOROV, T. V. SEBEKINA, T. M. SINITSYNA, YE. N. STRELTSOVA, V. M. VAKULENKO, and T. G. NIKOLAYEVA *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 4-5 14 Sep. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 24, no. 2, May-Jun. 1990 p 35-40 Avail: NTIS HC/MF A04

A variety of research and diagnostic techniques, including EKG, Doppler echocardiography, Xe-133 labels, etc., were employed in an assessment of human cerebral and systemic circulation during stress. The results demonstrated that intense mental activity potentiated cerebral blood flow, particularly in the supramarginal convolution of the brain, as well as in the angular convolution and in the parietotemporal and occipital region of the left cerebral hemisphere. In most cases an increased flow was also detected in the upper frontal convolution, Broca's convolution, and the superior temporal convolution. Prolonged bed rest was also observed to be a stressful situation predisposing to hypertension. The data were consistent with the view that maximum mental concentration was accompanied by a decrease in heart rate, but that in the majority of cases changes in regional and systemic hemodynamics are predicated on the emotional component of any activity. Cerebral hemodynamics in situations of intense mental activity appear to be closely connected to processes directed at maintaining optimum mental function and seem to be adaptive in nature. In general, mental activity within

N91-18594# Pacific Northwest Lab., Richland, WA. Life Sciences Center.

the framework of time constraints evoked hemodynamic changes

that were as pronounced as those induced by submaximal physical

REVISION OF THE ICRP DOSIMETRIC MODEL FOR THE HUMAN RESPIRATORY TRACT

W. J. BAIR Dec. 1990 10 p Presented at the 21st Annual NIRS Symposium on Inhalation of Airborne Particles and Induction Mechanisms, Japan, 7-9 Dec. 1989: and at the 3rd International Workshop on Respiratory Tract Dosimetry, Albuquerque, NM, 1-3 Jul. 1990

(Contract DE-AC06-76RL-01830)

demands.

(DE91-005086; PNL-SA-17594; CONF-891290-2; CONF-900733-1) Avail: NTIS HC/MF A02

Although the dosimetric model of the respiratory tract used in ICRP (International Comission on Radiological Protection) Publication 30 had not been shown to be seriously deficient for the purpose of calculating Annual Limits on Intake (ALIs) for workers, the availability of new information led the ICRP in 1984 to create a special Task Group to review the dosimetric model of the respiratory tract and, if justified, propose revisions or a new model. The Task Group directed its efforts toward improving the model used in Publication 30 rather than developing a completely new model. The objective was a model that would facilitate calculation of biologically meaningful doses; be consistent with morphological, physiological, and radiobiological characteristics of the respiratory tract; incorporate current knowledge; meet all radiation protection needs; be user friendly by not being unnecessarily sophisticated; be adaptable to development of computer software for calculation of relevant radiation doses from knowledge of a few readily measured exposure parameters; be equally useful for assessment purposes as for calculating ALIs: be applicable to all members of the world population; and consider the influence of smoking, air pollutants, and diseases of the inhalation, deposition, and clearance of radioactive particles from the respiratory tract. The model provides for calculation of a committed dose equivalent for each region, adjusted for the relative cancer sensitivity of that region, and for the summing of these to yield a committed dose equivalent for the entire respiratory tract.

DOE

Author

N91-18595# New York Univ. Medical Center. -ONCOGENIC ACTION OF IONIZING RADIATION

1990 38 p

(Contract DE-FG02-87ER-60539)

(DE91-005979; DOE/ER-60539/T4) Avail: NTIS HC/MF A03

An extensive experiment involving approximately 400 rats exposed to the neon ion beam at the Bevalac in Berkeley, CA and to electrons is nearing completion. The carcinogenicity of energetic electrons was determined for comparison with the neon ion results. As in past reports we will describe progress in three areas corresponding to the specific aims of the proposal: (1) carcinogenesis and DNA strand breaks in rat skin following exposure by the neon ions or electrons; (2) DNA strand breaks in the epidermis as a function of radiation penetration; (3) oncogene activation in radiation-induced rat skin cancers.

N91-18596# Massachusetts General Hospital, Boston. NEW IMAGING SYSTEMS IN NUCLEAR MEDICINE 1990 10 p

(Contract DE-FG02-87ER-60519)

(DE91-004782; DOE/ER-60519/T2) Avail: NTIS HC/MF A02

Further progress has been made on improving the uniformity and stability of PCR-I, the single ring analog coded tomograph. This camera has been employed in a wide range of animal studies described below. Data from PCR-I have been used in various image processing procedures. These include motion pictures of dog heart, comparison of PET and MRI image in dog heart and rat brain and quantitation of tumor metabolism in the nude mouse using blood data from heart images. A SUN workstation with TAAC board has been used to produce gated three-dimensional images of the dog heart. The ANALYZE program from the Mayo Clinic has also been mounted on a SUN workstation for comparison of images and image processing.

N91-18597# Lawrence Livermore National Lab., CA. Center for Accelerator Mass Spectrometry.

NEW BIOMEDICAL APPLICATIONS OF RADIOCARBON

J. C. DAVIS Dec. 1990 14 p Presented at the 40th Anniversary Conference on Radiocarbon, Lake Arrowhead, CA, Jun. 1990 Submitted for publication

(Contract W-7405-ENG-48)

(DE91-006249; UCRL-JC-105825; CONF-9006308-1) Avail: NTIS HC/MF A03

The potential of accelerator mass spectrometry (AMS) and radiocarbon in biomedical applications is being investigated by Lawrence Livermore National Laboratory (LLNL). A measurement of the dose-response curve for DNA damage caused by a carcinogen in mouse liver cells was an initial experiment. This demonstrated the sensitivity and utility of AMS for detecting radiocarbon tags and led to numerous follow-on experiments. The initial experiment and follow-on experiments are discussed in this report.

N91-18598# Texas A&M Univ., College Station. Dept. of Nuclear

CONSIDERATIONS OF BETA AND ELECTRON TRANSPORT IN INTERNAL DOSE CALCULATIONS Progress Report

WESLEY E. BOLCH and JOHN W. POSTON, SR. Dec. 1990

(Contract DE-FG05-88ER-60707)

(DE91-006251; DOE/ER-60707/T1) Avail: NTIS HC/MF A03

lonizing radiation has broad uses in modern science and medicine. These uses often require the calculation of energy deposition in the irradiated media and, usually, the medium of interest is the human body. Energy deposition from radioactive sources within the human body and the effects of such deposition are considered in the field of internal dosimetry. In July of 1988, a three-year research project was initiated by the Nuclear Engineering Department at Texas A and M University under the sponsorship of the U.S. Department of Energy. The main thrust of the research was to consider, for the first time, the detailed spatial transport of electron and beta particles in the estimation of average organ doses under the Medical Internal Radiation Dose (MIRD) schema. At the present time (December of 1990), research activities are continuing within five areas. Several are new initiatives

begun within the second or third year of the current contract period. They include: (1) development of small-scale dosimetry; (2) development of a differential volume phantom; (3) development of a dosimetric bone model; (4) assessment of the new ICRP lung model; and (5) studies into the mechanisms of DNA damage. A progress report is given for each of these tasks within the Comprehensive Report. In each use, preliminary results are very encouraging and plans for further research are detailed within this document.

N91-18599# National Aerospace Medical Centre, Soesterberg (Netherlands).

THE INCIDENCE OF SLEEP DISTURBANCES IN DUTCH COCKPIT CREW OPERATING ON TRANSMERIDIAN ROUTES

M. SIMONS and P. J. L. VALK 1989 12 p Presented at the 37th Curation and Space Medicine International Congress, Cairo, Egypt, 15-20 Oct. 1989

(ETN-91-98697) Avail: NTIS HC/MF A03

An inquiry into the occurrence of sleep disturbances among cockpit crew of two Dutch commercial airlines is described. Questionnaires were sent to 1191 cockpit crewmembers. Each anomymized questionnaire comprised 24 items concerning sleep and the use of sleeping aids at home and en route over the last 6 months. The Groningen sleep quality scale was used to evaluate the quality of sleep. The response percentage was 60. A positive correlation between operating on transmeridian flights and complaints about the quality of sleep was demonstrated. The sleep quality en route was significantly worse than at home. Forty seven percent of the transmeridian flying crewmembers with sleep disturbances judged their disturbed sleep to affect their performance in the cockpit. Among the sleeping aids used during lay overs were alcohol (42 percent) and hypnotics (10 percent). It is concluded that transmeridian operations cause significant complaints about the quality of sleep in a large group of Dutch cockpitcrew. A disturbed sleep and the use of sleeping aids, such as alcohol and hypnotics might affect flight safety.

N91-18600# Los Alamos National Lab., NM. A COMPUTATIONAL MODEL OF THE CEREBELLUM

B. J. TRAVIS 1990 7 p Presented at the Analysis and Modeling of Neural Systems Workshop, Berkeley, 25-27 Jul. 1990 (Contract W-7405-ENG-36)

(DE91-004824; LA-UR-90-3733; CONF-9007190-1) Avail: NTIS HC/MF A02

The need for realistic computational models of neural microarchitecture is growing increasingly apparent. While traditional neural networks have made inroads on understanding cognitive functions, more realism (in the form of structural and connectivity constraints) is required to explain processes such as vision or motor control. A highly detailed computational model of mammalian cerebellum was developed. It is being compared to physiological recordings for validation purposes. The model is also being used to study the relative contributions of each component to cerebellar processing.

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A91-24320#

THE NOE FLIGHTS AND THEIR EFFECT UPON A PILOT

R. WITKOWSKI (Instytut Lotnictwa, Warsaw, Poland) IN: ICAS, Congress, 17th, Stockholm, Sweden, Sept. 9-14, 1990, Proceedings. Vol. 1. Washington, CC, American Institute of Aeronautics and Astronautics, Inc., 1990, p. 151-157. refs Copyright

The effects of NOE helicopter flight on pilot emotional state

and eyesight use are discussed in view of flight tests, encompassing six 'horizontal' and four 'vertical' maneuvers, which were conducted by a Mi-2 helicopter. These tests have revealed a differentiation in the effect of maneuvers on the emotional state of the pilot; the most distressing maneuvers were those involving a coupling of vertical maneuvers with rapid descent. Heartbeat rates exceeding normal by 60 percent were recorded in such cases. Oculographic tests confirmed that the pilot's sight is not stabilized in one direction during NOE, but rather alternates between the outside and the instrument panel. This underscores the need for incorporating HUDs on NOE-mission helicopters.

A91-25100 VERTICAL DISPARITIES AND PERCEPTION OF THREE-DIMENSIONAL SHAPE

B. G. CUMMING, E. B. JOHNSTON, and A. J. PARKER (Oxford, University, England) Nature (ISSN 0028-0836), vol. 349, Jan. 31, 1991, p. 411-413. Research supported by the Medical Research Council, SERC, and Wellcome Trust. refs

Handom dot stereograms are used here in a shape judgment task to show that changes in vertical disparities have no effect on perceived three-dimensional shape. Changes in ocular convergence do alter perceived shape, suggesting substantial changes in the subjects' scaling of horizontal disparities. It is concluded that vertical disparities are not used to scale disparities for viewing distance, and that extraretinal signals must be considered when analyzing human three-dimensional shape perception.

A91-26782 AVIATION PSYCHOLOGY

RICHARD S. JENSEN, ED. (Ohio State University, Columbus) Aldershot, England and Brookfield, VT, Gower Technical, 1989, 438 p. For individual items see A91-26783 to A91-26797.

Topics presented include a study of the human factors in the super cockpit, the cognitive demands of automation in aviation, some implications of automation on air traffic control, and special considerations for helicopter safety. Also presented are personality assessment in aviator selection, the selection and screening programs for air traffic control specialists, aircrew performance assessment, and human performance aspects of aircraft accidents.

A91-26789

PILOT DECISION MAKING AND JUDGEMENT

ROSS TELFER IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 154-175. refs

Evaluation and results are discussed that cover the pilot judgment studies instituted by the FAA to develop, evaluate and implement appropriate training materials and methods. To evaluate pilot judgments in a realistic setting, flight students submit to a flight check conducted by an experienced flight instructor. After each flight the instructor rates the pilot performance on each judgment situation on the basis of a five point scale ranging from four (sound judgment) to zero (dangerous judgment) with the intermediary rankings allowed for variations in judgment limitations or quality in the opportunity to demonstrate it. A principal section of the student manual employed in training introduces judgment and the subjects about which judgments are made. The student manual also deals with stress, its origins, recognition, its effects on information processing, and relieving stress. Aside from a confirmation of the efficacy of pilot judgment training, other beneficial results include an emphasis on instructional planning, anxiety and stress, differentiation of decision-making and pilot judgment, flight skills, line oriented flight training, and cockpit resource management.

A91-26792

MEASURES OF IN-FLIGHT WORKLOAD

VALERIE J. GAWRON, SAMUEL G. SCHFLETT, and JAY C.

MILLER IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 240-287. refs Copyright

As both system performance and safety are dependent on operator workload, NASA, the FAA and all three services are evaluating and developing empirical measures of workload to be utilized in flight. A review is presented of this evaluation including a general description, a discussion of weaknesses and strengths, and guidelines for utilization. Two common elements defining pilot workload are what the pilot is required to accomplish with the aircraft and the conditions under which the required operation is to be conducted. There are three uses for workload measurement:

(1) to predict the workload demands of a particular system configuration before it reaches production or simulation, (2) to assess workload demands of already existing systems, and (3) the online monitoring of workload. Finally, a summary of workload validation studies is presented.

A91-26793

PERSONALITY ASSESSMENT IN AVIATOR SELECTION

DANIEL L. DOLGIN and GERALD D. GIBB IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 288-320. refs Copyright

This paper examines the personality factors employed to predict performance in aviation. Historical information on the methods developed during and after World War I to develop applied psychology in the aviator selection process is presented. In general, results obtained were not favorable when personality inventories were validated against performance criteria. The principal reason for this was that the preselection of candidates eliminated abnormal individuals, and that performance measures were unreliable and invalid. Various tests conducted by the U.S. military air services and British and Scandinavian forces are described. New automated behavior-based inventories are discussed and it is shown that aviation selection appears to be most promising in the area of computer administration and in concealing the personality trait of interest.

A91-26794

SELECTION AND SCREENING PROGRAMS FOR AIR TRAFFIC CONTROL

CAROL A. MANNING, PAMELA S. KEGG, and WILLIAM E. COLLINS IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 321-341. refs Copyright

A review is presented of the training, responsibilities, and screening programs for the air traffic control specialist in the FAA. The selection and screening process that applies to those ATCS personnel assigned to the terminal and enroute options is described. Each candidate for the position is continually evaluated, from an initial aptitude selection test battery through performance-based screening at the FAA Academy, and eventually in on-the-job training, performed at the facility assigned. Due to the critical safety-related aspects of the work, screening adidentifying characteristics in individuals that can predict successful operation in air traffic are particularly important. General selection guidelines are discussed along with selection procedures, the FAA Academy, effectiveness of the placement process, and the utility of ATCS academy screening.

A91-26795

AIRCREW PERFORMANCE ASSESSMENT

DAVID C. HUBBARD, MARTY R. ROCKWAY, and WAYNE L. WAAG IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 342-377. refs Copyright

Aircrew performance measurement is the act of determining the quantity, quality, and dimensions of aircrew performance by comparison against a standard. The three principal applications for aircrew performance measurement are aircrew selection, aircrew training, and research. An evaluation of the C-130 weapon system trainer is presented as an example to identify and discuss various measurement and methodology issues that are relevant to the evaluation of students, media, and aircrew training methods in a real-world environment. Expert systems focusing on air combat are also discussed and it is shown that this technique may be applied to other measurement areas, particularly those necessitating the evaluation of performance in complex situations and higher order aircrew proficiency.

A91-26796 HUMAN PERFORMANCE ASPECTS OF AIRCRAFT ACCIDENTS

ALAN E. DIEHL IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 378-403. refs

An overview is presented of the theory and practice of investigating the human performance aspects of aircraft accidents. The complex issues involved in the investigation procedures are discussed along with case studies which show the potential benefits of conducting detailed human performance analyses. Psychologists are becoming an integral part of the modern interdiscipinary teams that investigate civil and military aviation accidents. The basic role of these psychologists is to assist in systematically recording and explaining the effects of factors connected with human performance degradation. Details are provided on the accident causation, investigation, and prevention processes including the role played by the flight surgeon, research psychologist, and human factor advocates.

A91-27826* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA. COCKPIT NAPPING

R. CURTIS GRAEBER, MARK R. ROSEKIND, LINDA J. CONNELL (NASA, Ames Research Center, Moffett Field, CA), and DAVID F. DINGES (Pennsylvania, University, Philadelphia) ICAO Journal (ISSN 0018-8778), vol. 45, Oct. 1990, p. 6-10. Copyright

The results of a NASA-sponsored study examining the effectiveness of a brief, preplanned cockpit rest period to improve pilot alertness and performance in nonaugmented long-haul flight operations are discussed. Four regularly scheduled trans-Pacific flight legs were studied. The shortest flight legs were about 7 h and the longest about 9.5 h, with duty periods averaging about 11 h and layovers about 25 h. Three-person B747 crews were divided randomly into two volunteer pilot groups. These crews were nonaugmented, and therefore no relief pilots were available. The rest group, consisting of four crews, was allowed a 40 min opportunity to rest during the overwater cruise portion of the flight. On a preplanned, rotating basis, individual crew members were allowed to nap. It is concluded that a preplanned cockpit nap is associated with significantly better behavioral performance and higher levels of physiological alertness and that this can be accomplished without disrupting normal flight operations or compromising safety.

A91-28169* National Aeronautics and Space Administration.
Ames Research Center, Moffett Field, CA.
OPTIMAL DISPLACEMENT IN APPARENT MOTION AND
QUADRATURE MODELS OF MOTION SENSING

ANDREW B. WATSON (NASA, Ames Research Center, Moffett Field, CA) Vision Research (ISSN 0042-6989), vol. 30, no. 9, 1990, p. 1389-1393. refs Copyright

A grating appears to move if it is displaced by some amount between two brief presentations, or between multiple successive presentations. A number of recent experiments have examined the influence of displacement size upon either the sensitivity to motion, or upon the induced motion aftereffect. Several recent motion models are based upon quadrature filters that respond in opposite quadrants in the spatiotemporal frequency plane. Predictions of the quadrature model are derived for both two-frame and multiframe displays. Quadrature models generally predict an optimal displacement of 1/4 cycle for two-frame displays, but in

the multiframe case the prediction depends entirely on the frame rate.

N91-17044*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

IN-FLIGHT CREW TRAINING

CHARLES GOTT, PETER GALICKI, and DAVID SHORES (Barrios Technology, Inc., Houston, TX.) In NASA, Washington, Space Transportation Avionics Technology Symposium. Volume 2: Conference Proceedings p 581-588 Aug. 1990
Avail: NTIS HC/MF A99 CSCL 05I

The Helmet Mounted Display system and Part Task Trainer are two projects currently underway that are closely related to the in-flight crew training concept. The first project is a training simulator and an engineering analysis tool. The simulator's unique helmet mounted display actually projects the wearer into the simulated environment of 3-D space. Miniature monitors are mounted in front of the wearers eyes. Partial Task Trainer is a kinematic simulator for the Shuttle Remote Manipulator System. The simulator consists of a high end graphics workstation with a high resolution color screen and a number of input peripherals that create a functional equivalent of the RMS control panel in the back of the Orbiter. It is being used in the training cycle for Shuttle crew members. Activities are underway to expand the capability of the Helmet Display System and the Partial Task Trainer.

N91-18577# Joint Publications Research Service, Arlington, VA. PSYCHOLOGICAL PREPARATION OF OPERATORS FOR ACTIVITY DURING SUSTAINED G-LOADS

A. A. OBOZNOV, V. A. PONOMARENKO, and D. YU. ARKHANGELSKIY *In its* JPRS Report: Science and Technology. USSR: Life Sciences p 3-5 2 Oct. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 23, no. 4, Jul.-Aug. 1989 p 26-29 Avail: NTIS HC/MF A04

The timely performance by an operator of protective measures (primarily the tensing at will of leg and abdominal muscles) prevents the development of visual disturbances accompanying G-loading and thus increases the reliability of his activity. The development of a special mental quality in the operator - the ability to divide one's attention between carrying out an operator task and performing protective measures - is the most important element in the psychological preparation of the individual for successful performance of operator tasks in conditions involving sustained G-loads. The possibility of developing a two-tiered system of mental regulation in ordinary conditions is studied.

N91-18588# Joint Publications Research Service, Arlington, VA. COLOR SELECTION IN LUSCHER TEST AS EMOTIONAL STATUS INDICATOR IN FLIGHT PERSONNEL Abstract Only O. N. KUZNETSOV, V. A. YEGOROV, and B. S. FRANTSEN In its JPRS Report: Science and Technology. USSR: Life Sciences p 2-3 14 Sep. 1990 Transl. into ENGLISH from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 24, no. 2, Mar.-Apr. 1990 p 15-18 Previously announced as X91-71314

Avail: NTIS HC/MF A04

Color selection in the Luscher test was used in the assessment of emotional status of flight instructors in various field-related situations. In comparison with the population at large, flight personnel showed preference for cooler colors, such as blue, green, or violet. This preference is taken to reflect emotional stress encountered by the pilots in day-to-day situations. In particular, preference for violet and green, a mixture of blue and red or blue and yellow, is understood to reflect adaptibility and flexibility in the face of stress.

N91-18593# Joint Publications Research Service, Arlington, VA. NEUROTIC AND PSYCHOSOMATIC RISK FACTORS IN FLIGHT PERSONNEL Abstract Only

V. I. YEVDOKIMOV In its UPRS Report: Science and Technology. USSR: Life Sciences p 5 (14 Sep. 1990 Transl. into ENGLISH

from Kosmicheskaya Biologiya i Aviakosmicheskaya Meditsina, Moscow (USSR), v. 24, no. 2, May-Jun. 1990 p 50-53 Avail: NTIS HC/MF A04

Flight proficiency testing was combined with personality assessment test in order to ascertain health risk factor in the case of pilots 121 and trainees with neurotic and psychosomatic disorders. In that group, 16 pilots and 8 trainees were diagnosed with asthenic problems, while 34 pilots, 21 pilot trainees, and 42 allied flight personnel were determined to suffer from a variety of psychosomatic disorders. The fundamental findings led to the conclusion that individuals at risk exhibited inadequate mental adaptive potential, in contrast to 165 control subjects without such problems.

N91-18601 Institute for Perception RVO-TNO, Soesterberg (Netherlands).

THE SELECTIVE LISTENING TASK AS A TEST FOR PILOTS AND AIR TRAFFIC CONTROLLERS Final Report

L. C. BOER, M. HARSVELD, and P. H. HERMANS (Marine Keuring en Selectie Centrum, Amsterdam, Netherlands) 2 May 1990 26 p In DUTCH; ENGLISH summary

(Contract A83/KLU/078)

(IZF-1990-A-18; TD-90-1608; ETN-91-98313) Copyright Avail: Institute for Perception RVO-TNO, P.O. Box 23, 3769 ZG

Soesterberg, Netherlands

The use of the Selective Listening Task (Gopher and Kahneman, 1971) as a test for pilots and air traffic controllers was evaluated. Task performance of samples from these populations (88 and 87, respectively) correlated significantly with later success in training. Apparently the task is a suitable selection device. Registration of training motivation revealed that this conclusion was independent of motivation differences. It is recommended to use the first half of the task only and to simplify the scoring procedure. The norms for the conversion of a number of errors to decile scores, based on a sample of 390 pilot applicants, are included.

N91-18622*# Houston Univ., Clear Lake, TX. Dept. of Reading and Language Arts.

AN OVERVIEW OF THE EDUCATION AND TRAINING COMPONENT OF RICIS Abstract Only

GLENN B. FREEDMAN *In its* RICIS 1987 Symposium. Executive Summary 1 p 1987

Avail: NTIS HC/MF A15 CSCL 09/2

Research in education and training according to RICIS (Research Institute for Computing and Information Systems) program focuses on means to disseminate knowledge, skills, and technological advances rapidly, accurately, and effectively. A range of areas for study include: artificial intelligence, hypermedia and full-text retrieval strategies, use of mass storage and retrieval options such as CD-ROM and laser disks, and interactive video and interactive media presentations.

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A91-24322#

MILITARY AIRCREW HEAD SUPPORT SYSTEM

R. S. DEAKIN (British Aerospace /Military Aircraft/, Ltd., Godalming, England) IN: ICAS, Congress, 17th, Stockholm, Sweden, Sept. 9-14, 1990, Proceedings. Vol. 1. Washington, DC, American Institute of Aeronautics and Astronautics, Inc., 1990, p. 162-167.

Copyright

This paper describes research work undertaken in order to determine a suitable method of supporting the military pilot's head

during high 'g' maneuvers, enabling him to maintain his head in an upright position, thereby enhancing his ability to monitor Head-Up Displays, and increasing his awareness of the situation outside the cockpit. The paper also describes how the Military Aircrew Head Support System can serve as an effective head restraint system during an ejection from the aircraft. A description is given of the work carried out to date and proposals for further work are also discussed.

A91-24332#

MODERN OXYGEN AND ANTI-G PROTECTION FOR THE PILOT OF ADVANCED FIGHTER AIRCRAFT SAAB JAS 39

RAYMOND BEAUSSANT (Intertechnique - Eros, Plaisir, France) IN: ICAS, Congress, 17th, Stockholm, Sweden, Sept. 9-14, 1990, Proceedings. Vol. 1. Washington, DC, American Institute of Aeronautics and Astronautics, Inc., 1990, p. 249-253. Copyright

A fighter pilot oxygen supply and anti-g regulation system has been designed which employs both a high performance anti-g valve and manually-selectable Assisted Possitive Pressure Breathing, and uses the gaseous oxygen supply as the basis of both g-valving and the pressure breathing regulator. The system provides an electronic warning monitor for the breathing function which is expected to be eventually extended to the anti-g function. This combination of pneumatic and electronic technologies is expected to furnish the highest levels of safety and performance.

O.C

A91-25845

A NEW TWO-DIMENSIONAL 'MAN-WCV' MATHEMATICAL MODEL OF THE HUMAN THERMOREGULATION

XIUGAN YUAN and BIN SHA (Beijing University of Aeronautics and Astronautics, People's Republic of China) Chinese Journal of Aeronautics (ISSN 1000-9361), vol. 3, Nov. 1990, p. 266-276. refs

Copyright

In this paper, a new two-dimensional 'man-WCV' (water cooling vest) mathematical model is developed. This model is of practical use: it can predict transient temperature responses and body temperature distribution for a person in a nonuniform hot environment, doing various jobs and dressed in different clothes. In addition, the results calculated from the model can be used to optimize the distribution of the tube-net lined on the WCV and to evaluate an individual thermal conditioning system with cooling water. The results obtained from the model agree well with experimental data.

A91-26608* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

THE NASA TELEROBOTICS RESEARCH PROGRAM

R. RHOADS STEPHENSON (JPL; California Institute of Technology, Pasadena) IN: Automatic control in aerospace; IFAC Symposium, Tsukuba, Japan, July 17-21, 1989, Selected Papers. Oxford, England and New York, Pergamon Press, 1990, p. 17-25. refs Copyright

An account is given to NASA efforts in the development of space telerobotics, which encompass mission analyses, core technology research, systems-integration testbed evaluations, ground-based demonstrations, and flight experiments. Space telerobotics applications encompass (1) The Space Shuttle Satellite Servicing System, (2) the Space Shuttle Orbiter's Remote Manipulator System, (3) the Space Station Freedom's Flight Telerobotics Servicer, Mobile Servicing Center, and Japanese Experiment Module, and (4) planetary rovers. A fundamental role is being played by NASA-Marshall, which possesses a Teleoperator and Robotics Evaluation Facility.

O.C.

A91-26620

SIMULATION SYSTEM FOR A SPACE ROBOT USING 6 AXIS SERVOS

H. SHIMOJI, M. INOUE, K. TSUCHIYA (Mitsubishi Electric Corp., Amagasaki, Japan), K. NINOMIYA, I. NAKATANI (Institute of Space and Astronautical Science, Sagamihara, Japan) et al. IN: Automatic

control in aerospace; IFAC Symposium, Tsukuba, Japan, July 17-21, 1989, Selected Papers. Oxford, England and New York, Pergamon Press, 1990, p. 115-120. refs
Copyright

The development of a space robot with a manipulator which is operated to catch and handle a target, in zero gravity environment, is described. In this case, the behavior of the robot main body caused by the reaction force exerted by the manipulator motion has to be taken into consideration in order to control the manipulator correctly. To solve this problem, a ground simulation system combining numerical simulation and servo mechanisms was constructed. On this system, dynamics of the space robot and the target is solved based on the momentum conservation law, and the relative motion between them is realized. Using this simulation system, space robots can be developed efficiently.

Author

A91-26621 THEORETICAL AND EXPERIMENTAL STUDY ON IN-ORBIT CAPTURE OPERATION WITH SATELLITE MOUNTED MANIPULATOR

Y. UMETANI and K. YOSHIDA (Tokyo Institute of Technology, Japan) IN: Automatic control in aerospace; IFAC Symposium, Tsukuba, Japan, July 17-21, 1989, Selected Papers. Oxford, England and New York, Pergamon Press, 1990, p. 121-126. refs Copyright

This paper treats both theoretical and experimental studies on a control problem of a space free-flying space manipulator, with an aim of developing a new control method for trajectory tracking or target capturing, considering the dynamical interaction between the manipulator arm and the base vehicle in space microgravity environment. In the theoretical study, the generalized Jacobian matrix (GJM) concept is introduced. By means of this new matrix, the conventional control methods for ground-fixed manipulators are directly applicable for space manipulators. In the experimental stydy, a laboratory model of a robot satellite supported on air bearings is developed in order to simulate the free-flying behavior of mechanical links in microgravity environment. An on-line resolved motion rate control scheme with vision feedback is developed for experimenting capture operations, utilizing the GJM. experimental results confirm the validity of the GJM concept and Author the proposed control method.

A91-26622 SIMULATION AND CONTROL OF SPACE MANIPULATORS BEARING COMPLEX PAYLOADS

P. CARTON, J. P. CHRETIEN (ONERA, Centre d'Etudes et de Recherches de Toulouse, France), and M. MAURETTE (CNES, Toulouse, France) IN: Automatic control in aerospace; IFAC Symposium, Tsukuba, Japan, July 17-21, 1989, Selected Papers. Oxford, England and New York, Pergamon Press, 1990, p. 127-132. CNES-supported research.

Copyright

Payloads to be handled by space manipulators cannot always be considered as inert bodies represented by mass and inertias. Modeling is considered in this paper from the point of view of the connection of a dynamic model of a payload to a general purpose multibody simulation package. Control issues are discussed in the framework of dynamic control, where the overall control loop is split up between an inner force control loop dependent only on the manipulator parameters, and an outer payload control loop whose adaptation to large inert and complex payloads is investigated.

Author

A91-26783

HUMAN FACTORS IN THE SUPER COCKPIT

THOMAS A. STINNETT IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 1-37. refs

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This paper presents a review of the evolution of the man-machine interface leading up to the super cockpit, identifying the most significant problems and the technical approaches

recommended to resolve them. Technically, the super cockpit faces many problems including: sensor and display processing, reliability, logistics and maintainability requirements, optics, pilot acceptance, and human factors. The concept of generating a 'virtual world' and a 'pilot's associate' are the most controversial issues. It is noted that the sensor fusion display development task should be organized towards for application to the super concept in its three areas of development going from the present, near-future, and far-future state-of-the-art.

A91-26784

CREW SYSTEMS DESIGN - SOME DEFENCE, PSYCHOLOGY FUTURES

ROBERT M. TAYLOR IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 38-49. refs Copyright

Airborne early warning (AEW) Nimrod system design and development is examined with particular regard to the aircrew facilities aspects. The system is compared to those systems employed aboard both the U.S. AWACS and F/A 18 aircraft. Only the AEW Nimrod utilizes duplicated scanners with limited transverse, which necessitates further duplication of scanner control and stabilization, a good part of the radar, electronic surveillance, and the IFF radar. A human-centered approach is recommended for future crew systems design, with a return to a more active role in the control loop for the human operator, aided by AI information management and decision support systems, basically directed at preserving adaptive control. It is noted that automation technology will be more acceptable and effective if it works in a fashion qualitatively similar to the way humans work and if it is adaptive and flexible.

A91-26785 SPEECH TECHNOLOGY IN THE COCKPIT

THOMAS J. MOORE IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 50-65. refs Copyright

Speech technology concerning human/machine interaction refers to voice input/output technology, where voice input is realized by use of a machine correctly identifying one of 'n' possible words, utterances or phrases and the voice output provides feedback, cautions, warnings or advisories to the talker/operator, while conducting in-flight, cockpit related applications and functions. Considerations that are addressed include speech synthesis, speech recognition, recognition algorithms, and the problems with cockpit application of speech recognition. It is concluded that template matching, isolated word, speaker dependent ASR systems are the only systems that appear to be viable for cockpit applications for the foreseeable future.

A91-26786

COGNITIVE DEMANDS OF AUTOMATION IN AVIATION

PAMELA S. TSANG and MICHAEL A. VIDULICH IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 66-95. refs

This paper focuses on the main cognitive tasks required of pilots in the face of automation. Both subjective and objective assessment techniques are evaluated and discussed. In order to understand the cognitive demands that the pilot experiences, it is necessary to understand the basic cognitive processing characteristics of the pilot, and devise methods for evaluating levels of cognitive demands. An empirical approach to understanding these cognitive demands on the pilot is described, which in turn identifies where automation is needed most. Cognitive demands, and therefore the necessity for automation, were evaluated by performance and subjective workload ratings. The performance data indicated that there was resource competition between the two tasks that were determined a priori to rely heavily on the response resources, i.e., the target acquisition and flight control tasks. RFP

A91-26787

IMPLICATIONS OF AUTOMATION ON AIR TRAFFIC CONTROL V. DAVID HOPKIN IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 96-108. refs

Air traffic control faces the continuous requirement to maintain and enhance its current high standards of efficiency and safety, while handling constantly increasing demands for ATC services from a great variety of operators. A review is presented on the implications of automation that include system constraints, ergonomics, staffing levels, error reduction, workload, stress, allocation of functions, and professional knowledge and attitudes. As for ergonomics, compromises have to be reached, taking into account the frequency and sequence in which controls and displays must be utilized to perform the complete range of tasks.

A91-26788 SIMULATION

EDWARD A. STARK IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 109-153. refs Copyright

An evolutionary overview of the simulator in aviation is presented. It is increasingly applied for flight crew training, systems training, and research into advanced flight technology. Simulators are utilized for three principal purposes: to facilitate the design of systems by allowing experimentation with different system configurations and modes of utilization without the requirement of constructing an actual system, to support applied and basic research in the definition of the fundamental principles of system operation, and to train personnel in the utilization and operation of systems. Further descriptions and details are provided on the uses of training simulators, the transfer of training, the simulator as a training device, the control of aircraft motion, simulator design and fidelity, and the simulator instructional system.

A91-26791 THE EYES PREFER REAL IMAGES

STANLEY N. ROSCOE IN: Aviation psychology. Aldershot, England and Brookfield, VT, Gower Technical, 1989, p. 231-239. Previously announced in STAR as N90-22938. refs Copyright

For better or worse, virtual imaging displays are with us in the form of narrow-angle combining-glass presentations, head-up displays (HUD), and head-mounted projections of wide-angle sensor-generated or computer-animated imagery (HMD). All military and civil aviation services and a large number of aerospace companies are involved in one way or another in a frantic competition to develop the best virtual imaging display system. The success or failure of major weapon systems hangs in the balance, and billions of dollars in potential business are at stake. Because of the degree to which national defense is committed to the perfection of virtual imaging displays, a brief consideration of their status, an investigation and analysis of their problems, and a search for realistic alternatives are long overdue.

A91-26825* National Aeronautics and Space Administration, Washington, DC.

TELEROBOTIC CONTROL ISSUES RELATED TO REAL TASK APPLICATIONS IN THE SPACE ENVIRONMENT

WAYNE ZIMMERMAN (NASA, Washington, DC) and control 1990; Proceedings of the Annual Rocky Mountain Guidance and Control Conference, Keystone, CO, Feb. 3-7, 1990. San Diego, CA, Univelt, Inc., 1990, p. 421-441. refs (AAS PAPER 90-054) Copyright.

Recent findings concerning the definition of the expected control environment associated with the Space Station are examined. The range of expected near-term and far-term task applications for robotic systems is provided, and the essential control issues related to the application environment are derived. In addition, an approximate control envelope for teleoperated and autonomous robotic systems is established.

A91-26832 Massachusetts Inst. of Tech., Cambridge, MIT-NASA/KSC SPACE LIFE SCIENCE EXPERIMENTS - A TELESCIENCE TESTBED

CHARLES M. OMAN (MIT, Cambridge, MA), BYRON K. LICHTENBERG (Payload Systems, Inc., Cambridge, MA), RICHARD L. FISER, and DEBORAH S. VORDERMARK (NASA, Kennedy Space Center, Cocoa Beach, FL) IN: Guidance and control 1990; Proceedings of the Annual Rocky Mountain Guidance and Control Conference, Keystone, CO, Feb. 3-7, 1990. San Diego, CA, Univelt, Inc., 1990, p. 575-589. MIT-supported research. refs

(Contract NAGW-1092)

(AAS PAPER 90-002) Copyright

Experiments performed at MIT to better define Space Station information system telescience requirements for effective remote coaching of astronauts by principal investigators (PI) on the ground are described. The experiments were conducted via satellite video. data, and voice links to surrogate crewmembers working in a laboratory at NASA's Kennedy Space Center. Teams of two Pls and two crewmembers performed two different space life sciences experiments. During 19 three-hour interactive sessions, a variety of test conditions were explored. Since bit rate limits are necessarily imposed on Space Station video experiments surveillance video was varied down to 50 Kb/s and the effectiveness of PI controlled frame rate, resolution, grey scale, and color decimation was investigated. It is concluded that remote coaching by voice works and that dedicated crew-PI voice loops would be of great value on the Space Station.

A91-26833* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA. TELESCIENCE - OPTIMIZING AEROSPACE SCIENCE RETURN THROUGH GEOGRAPHICALLY DISTRIBUTED OPERATIONS DARYL N. RASMUSSEN (NASA, Ames Research Center, Moffett Field, CA) and ARSHAD M. MIAN (NASA, Ames Research Center; General Electric Co., Moffett Field, CA) IN: Guidance and control 1990; Proceedings of the Annual Rocky Mountain Guidance and Control Conference, Keystone, CO, Feb. 3-7, 1990. San Diego. CA, Univelt, Inc., 1990, p. 591-600. refs

(AAS PAPER 90-003) Copyright The paper examines the objectives and requirements of

teleoperations, defined as the means and process for scientists, NASA operations personnel, and astronauts to conduct payload operations as if these were colocated. This process is described in terms of Space Station era platforms. Some of the enabling technologies are discussed. including open architecture workstations, distributed computing, transaction management. expert systems, and high-speed networks. Recent testbedding experiments are surveyed to highlight some of the human factors requirements.

A91-26834* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

APPLIED HUMAN FACTORS RESEARCH AT THE NASA JOHNSON SPACE CENTER HUMAN-COMPUTER INTERACTION LABORATORY

MARIANNE RUDISILL (NASA, Johnson Space Center, Houston, TX) and TIMOTHY D. MCKAY (Lockheed Engineering and Sciences Co., Houston, TX) IN: Guidance and control 1990; Proceedings of the Annual Rocky Mountain Guidance and Control Conference, Keystone, CO, Feb. 3-7, 1990. San Diego, CA, Univelt, Inc., 1990, p. 601-611. rets

(AAS PAPER 90-004) Copyright

The applied human factors research program performed at the NASA Johnson Space Center's Human-Computer Interaction Laboratory is discussed. Research is conducted to advance knowledge in human interaction with computer systems during space crew tasks. In addition, the Laboratory is directly involved in the specification of the human-computer interface (HCI) for space systems in development (e.g., Space Station Freedom) and is providing guidelines and support for HCl design to current and future space missions.

A91-26835* Jet Propulsion Lab., California Inst. of Tech.,

WORKSPACE VISUALIZATION AND TIME-DELAY TELEROBOTIC OPERATIONS

P. S. SCHENKER and A. K. BEJCZY (JPL, Pasadena, CA) IN: Guidance and control 1990; Proceedings of the Annual Rocky Mountain Guidance and Control Conference, Keystone, CO, Feb. 3-7, 1990. San Diego, CA, Univelt, Inc., 1990, p. 613-624. refs (AAS PAPER 90-005) Copyright

The paper examines the performance of telerobotic tasks where the operator and robot are physically separated, and a communication time delay of up to several seconds between them exists. This situation is applicable to space robotic servicing-assembly-maintenance operations on low earth or geosynchronous orbits with a ground-based command station. Attention is given to two developments which address advanced time-delay teleoperations for unstructured tasks: (1) the 'phantom robot', a real-time predictive graphics simulator developed to allow teleoperator eye-to-hand coordination or robot free-space kinematics under a time delay of several seconds; and (2) shared compliance control, a modified form of automatic electromechanical impedance control employed in parallel with manual position control to permit soft contact and grasp compliance with workpiece geometry under a time delay of several seconds.

A91-26836

NEW DESIGN STRATEGIES AND TECHNOLOGIES FOR OPERATOR-MACHINE INTERFACE FOR SPACE PLATFORM DESIGN, OPERATIONS, AND PLANNING

J. L. NEVINS, D. E. WHITNEY, and R. W. METZINGER (Charles Stark Draper Laboratory, Inc., Cambridge, MA) IN: Guidance and control 1990; Proceedings of the Annual Rocky Mountain Guidance and Control Conference, Keystone, CO, Feb. 3-7, 1990. San Diego, CA, Univelt, Inc., 1990, p. 625-633. refs (AAS PAPER 90-006) Copyright

(AAS PAPER 90-006) Copyright

It is proposed that considerable gains in efficiency can be achieved in the areas of space platform design and construction as well as in the planning and execution of space operations by the application of recent advances in manufacturing technology. The advances which are considered applicable include the concurrent design or engineering strategy and new sensor capabilities which will perform wrist force sensing and target location determination. It is pointed out that these devices can augment the capabilities of conventional manipulator devices.

L.M.

A91-26837* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX. MULTIPLE MANIPULATOR CONTROL FROM ORBITER FOR

MULTIPLE MANIPULATOR CONTROL FROM ORBITER FOR SPACE STATION ASSEMBLY

CHARLES R. PRICE and SUSAN H. BURNS (NASA, Johnson Space Center, Houston, TX) IN: Guidance and control 1990; Proceedings of the Annual Rocky Mountain Guidance and Control Conference, Keystone, CO, Feb. 3-7, 1990. San Diego, CA, Univelt, Inc., 1990, p. 635-639.

(AAS PAPER 90-007) Copyright

This paper discusses the assembly process of the Space Station Freedom. It is shown that the assembly of the Space Station will require 29 flights of the Space Shuttle Orbiter: six shuttle flights during the initial assembly stage when the Space Station will not have sufficient life-support capability; seven more flights before the Station will support human occupation independent of the presence of the Space Shuttle; and 16 more flights for achieving full operational capability. The shuttle systems to be used in the Space Station assembly are described together with the results of simulation and analyses. Special attention is given to the Space Shuttle Remote Manipulator System which will be available on all Shuttle flights to support the Space Station assembly.

A91-26903

CURRENTS INDUCED IN AN ANATOMICALLY BASED MODEL OF A HUMAN FOR EXPOSURE TO VERTICALLY POLARIZED ELECTROMAGNETIC PULSES JIN-YUAN CHEN and OM P. GANDHI (Utah, University, Salt Lake City) IEEE Transactions on Microwave Theory and Techniques (ISSN 0018-9480), vol. 39, Jan. 1991, p. 31-39. USAF-supported research. refs Copyright

The finite-difference time-domain (FDTD) technique is used to calculate the internal fields and the induced current densities in anatomically based models of a human using 5628 or 45,024 cubical cells of dimensions 2.62 and 1.31 cm, respectively. A layer of dielectric constant of epsilon(r) = 4.2 and having a thickness of 2.62 cm is assumed under the feet to simulate a human wearing rubber-soled shoes. The total induced currents for the various sections of the body and the specific absorptions for several organs are given for two representative electromagnetic pulses. The calculated results for the induced currents are in excellent agreement with the data measured for a human subject. The FDTD method is ideally suited for exact representation of the pulse shapes and offers numerical efficiency to allow detailed modeling of the human body and the various organs.

A91-26926

ACTIVE FORCE REFLECTION DEVICES IN TELEOPERATION

D. W. REPPERGER (USAF, Armstrong Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH) IEEE Control Systems Magazine (ISSN 0272-1708), vol. 11, Jan. 1991, p. 52-56. refs Copyright

A methodology for designing force-reflecting active controllers in cases involving teleoperation is presented. Certain types of force loop are shown to provide more information about the environment to the human that improves interaction. The procedure of modulating the controller to match the integral of its inverse mechanical impedance to the plant is given. Experimental data involving subjects are used to validate the approach.

A91-27694 BIOSPHERE II - CLOSED ECOLOGICAL SYSTEMS ENGINEERING

WILLIAM F. DEMPSTER (Space Biospheres Ventures, Oracle, AZ) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1206-1215. Copyright

This paper provides a general description of the Biosphere II project - a 3.15 acre materially closed ecological system containing tropical rainforest, savannah, marsh, marine, desert, intensive agriculture and human habitat biomes - currently under construction and scheduled for completion in September 1990. It further describes the approach taken to solve particular problems that arise due to the fact that the system is completely materially closed and contains several complex ecosystems. Materials selection for avoidance of contamination and methods of controlling contamination are discussed. A method for pumping water which is benign to life forms in the water is described. Systems choices are strongly influenced by the criterion of no external resupply of equipment, spare parts, or consumables for very long durations. The Biosphere II project is aimed at creating regenerative ecological systems as life habitat prototypes for space locations, and to conduct ecological research applicable to the biosphere of the earth.

A91-27695* Lockheed Missiles and Space Co., Sunnyvale, CA. CONCEPTUAL DESIGN FOR A LUNAR-BASE CELSS

STEVEN H. SCHWARTZKOPF (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) and HATICE S. CULLINGFORD (NASA, Johnson Space Center, Houston, TX) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1216-1225. refs

Copyright

Future human exploration is key to the United States National

Space Policy goal of maintaining a world leadership position in space. In the past, spacecraft life support systems have used open-loop technologies that were simple and sufficiently reliable to demonstrate the feasibility of spaceflight. A critical technology area needing development in support of both long duration missions and the establishment of lunar or planetary bases is regenerative life support. The information presented in this paper describes a conceptual design of a Lunar Base Controlled Ecological Life Support System (LCELSS) which supports a crew size ranging from 4 to 100. The system includes, or incorporates interfaces with, eight primary subsystems. An initial description of the Lunar-Base CELSS subsystems is provided within the framework of the conceptual design. The system design includes both plant (algae and higher plant) and animal species as potential food Author sources.

A91-27696

INVESTIGATION OF HVAC SYSTEMS IN LOW GRAVITY APPLICATION

DAVID L. SHARP (Fluor Daniel, Inc., Irvine, CA) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1226-1232. refs

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This paper has been developed to identify and summarize the principal areas of investigation necessary to design and install functional HVAC systems in low gravity applications. These investigations must consider design, construction and control details and restrictions for systems and components. Included in these investigations should be subjects such as the mechanics of prime movers in lunar gravity, temperature and pressure requirements, air distribution methods and physical size, transport velocity requirements, resources recovery interface with life support systems and both energy consumption and conservation. A suggestion of priorities for the investigations is presented. These priorities have been established to support development of basic design criteria and methods for functional HVAC systems. Further investigation of more detailed subjects can be performed at a Author later date.

A91-27697

COMPOSTING FOR LUNAR AGRICULTURE

JUDITH FIELDER and NICKOLAUS LEGGETT IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1233-1241. refs

Copyright

A study is presented of alternative technologies for the microbially mediated biological oxidative transformation of human and other organic wastes. Continuous process and batch mode composters are developed to convert waste materials into a form that is a useful input for lunar agriculture. Waste materials are composted during a period of time and the composted material that results is added to an engineered soil in plant growth chambers. It is shown that composting technology utilized in conjunction with a regolith-derived soil for agriculture permits organic wastes to be effectively recovered for reuse in the production of food. R.E.P.

A91-27698

FLUID BEHAVIOR CONSIDERATIONS FOR WASTE MANAGEMENT IN LOW-GRAVITY ENVIRONMENTS

ANTHONY M. WACHINSKI (U.S. Air Force Academy, Colorado Springs, CO) and KURT T. PRESTON (Purdue University, West Lafayette, IN) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1242-1248. refs Copyright

Design of waste recycling systems for spacecraft requires a knowledge of fluid behavior in microgravity. As gravity is reduced, phenomena usually ignored in the One-G environment of earth can dominate physical or biological processes. This paper provides an explanation of Zero-G, microgravity terminology, and microgravity fluid behavior. Its purpose is to educate civil engineers and waste management professionals on Zero-G basics. Author

A91-27708 A PROTOTYPE MODEL FOR HUMAN/AUTOMATION TRADE-OFFS

RICHARD JOHNSON (Colorado, University, Boulder) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1334-1343. refs
Copyright

Future space construction missions will involve both human and machine constructors. Selection of the optimum constructor mix requires a model of constructor capabilities and requirements. The database for that model is developed via extrapolation from current literature. Optimization is done via minimization of total mission cost using a linear programming approach. This prototype is the first cut at producing a general tool for choosing a near-optimum constructor mix for any space construction mission. The linear programming optimization model illuminates several significant representational and data-gathering problems. Author

A91-27712

ARTIFICIAL GRAVITY - HUMAN FACTORS DESIGN REQUIREMENTS

STEPHEN D. CAPPS (Boeing Aerospace and Electronics, Huntsville, AL) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1374-1382. refs Copyright

The effects of prolonged exposure to weightlessness on humans are considered. The challenge of creating environments conducive to the average human as well as creating the means of human survival for extended space flight and settlement is examined. Since the environment created by spinning a vehicle differs substantially from earth gravity, design limitations such as artificial gravity level, gravity gradient, Coriolis forces, tangential motion, and locomotion are analyzed. The results of adaptation schedule experiments are presented. A set of human factors design requirements pertaining to the upper level of angular velocity, upper and lower gravity levels, gravity gradients, radial traffic, transport across spin axis, and human activity at the hub is recommended. Rotating habitats are considered to be the only comprehensive solution for determining the exact human factors envelope. O.G.

A91-27713* Boeing Co., Huntsville, AL.

PARTIAL GRAVITY - HUMAN IMPACTS ON FACILITY DESIGN STEPHEN CAPPS (Boeing Aerospace and Electronics, Huntsville, AL) and NATHAN MOORE (NASA, Johnson Space Center, Houston, TX) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1383-1392. refs Copyright

Partial gravity affects the body differently than earth gravity and microgravity environments. The main difference from earth gravity is human locomotion; while the main dfference from microgravity is the specific updown orientation and reach envelopes which increase volume requirements. Much data are available on earth gravity and microgravity design; however, very little information is available on human reactions to reduced gravity levels in IVA situations (without pressure suits). Therefore, if humans commit to permanent lunar habitation, much research should be conducted in the area of partial gravity effects on habitat design.

A91-27717

WORKING ON THE MOON - THE APOLLO EXPERIENCE

ERIC M. JONES (Los Alamos National Laboratory, NM)

Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1423-1432. Research supported by Los Alamos National Laboratory. Previously announced in STAR as N90-19744.

Copyright

During the six completed landing missions, Apollo lunar surface crews conducted 160 astronaut-hours of EVAs and also conducted a similar sum of procedures. The ability to land equipment and consumables was very modest but, despite stay times of no more than 32 hours, the crews of Apollos 11, 12, and 14 were able to test their mobility and their capability of doing useful work outside the spacecraft. For the last three missions, thanks to landing module modifications which enabled landings with significant amounts of cargo, stay times more than doubled to three days. The crews were able to use lunar rovers to conduct extensive local exploration and to travel up to 10 km away from their immediate landing sites.

A91-27727

LEVEL OF RECYCLING EFFECTIVENESS

DICK B. PARKER (North Dakota, University, Grand Forks) IN: Engineering, construction, and operations in space II; Proceedings of Space 90, the Second International Conference, Albuquerque, NM, Apr. 22-26, 1990. Vol. 2. New York, American Society of Civil Engineers, 1990, p. 1533-1542. Copyright

The Level of Recycling Effectiveness (LORE) scale is presented. It is a conceptual framework for evaluating recycling and other alternative strategies of meeting needs in space activities. The LORE scale is developed, defined, and examples of its use are given. The LORE scale should help reduce planning time by serving as a framework within which initial thinking can take place when selecting between alternatives.

N91-17048*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

PAYLOAD DEPLOYMENT SYSTEMS AND ADVANCED MANIPULATORS

In NASA, Washington, Space Transportation Avionics Technology Symposium. Volume 2: Conference Proceedings p 657-662 Aug. 1990

Avail: NTIS HC/MF A99 CSCL 05H

The results of discussions on future development of avionics to support payload deployment systems and advanced manipulators are discussed. The discussions summarized here were held during the Space Transportation Avionics Technology Symposium in Williamsburg, Virginia on November 7 to 9, 1989. Symposium participants agreed that this subpanel would have benefitted from more participation by users. It was suggested that inputs from Shuttle payload users should be incorporated, either by direct discussions with users or by incorporating comments from users as kept by Payload Accommodations. The Jet Propulsion Laboratory (JPL), Goddard, and Langley, as builders of payloads, and the Space Station Utilization Office could also provide useful inputs. Other potential users for future systems should also be identified as early as possible to determine what they anticipate their needs to be. Symposium participants also recognized that payload deployment is normally not a safety critical area, and as such, is vulnerable to budget cuts that defer costs from development to operations. This does give opportunities for upgrades of operational systems, but these must be very cost effective to compete with vehicle requirements that enhance safety or increase lifetime.

N91-17542# Air Force Human Resources Lab., Brooks AFB, TX. Logistics and Human Factors Div.

DESIGN EVALUATION FOR PERSONNEL, TRAINING, AND HUMAN FACTORS (DEPTH) Interim Technical Paper, Dec. 1989 - Jun. 1990

EDWARD S. BOYLE, JILL A. EASTERLY, and JOHN D. IANNI Jul. 1990 23 p Submitted for publication

(Contract AF PROJ. 2940) (AD-A224757; AFHRL-TP-90-57) Avail: NTIS HC/MF A03 CSCL 23/2

This paper describes a new direction in human factors research called Design Evaluation for Personnel, Training, and Human Factors (DEPTH). This research utilizes computer-aided design (CAD) man-modeling and data base technologies to foster a human-centered approach to weapon system design. The ability to graphically simulate maintenance work underlies this research. Visualizing maintenance tasks will allow more accurate and complete descriptions of human performance requirements during design. This man-modeling capability will utilize a computer graphic workstation capable of importing CAD data and will build upon technology developments of CREW CHIEF, a model of a maintenance technician developed by Air Force Human Resources Laboratory (AFHRL) and Armstrong Aerospace Medical Research Laboratory (AAMRL). Additional capabilities include detailed hand and vision models, multi-person task performance simulation, the effects of environmental, and animated simulations of complete maintenance tasks. Logistics Support Analysis (LSA), training, and personnel information will be derived from these simulations and presented in a usable format.

N91-17543# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

THE CONTROL OF HUMAN ARM MOVEMENT: MODELS AND MECHANICAL CONSTRAINTS Ph.D. Thesis

DAVID J. BENNETT Jun. 1990 202 p (Contract N00014-86-K-0180; N00014-85-K-0124; NIH-AM-26710) (AD-A228690; Al-TR-1234) Avail: NTIS HC/MF A10 CSCL 05/8

The role is studied of structured models in autonomous motor learning. Any autonomous system, such as the human motor system, has only the internal consistency of its various sensors to rely upon for model building (learning). To study the possibility of learning structured models from internal consistency constraints, the specific problem of learning the kinematic parameters (relative link orientations and length) of general revolute joint manipulators is explored. First it is noted that a manipulator may form a mobile closed kinematic chain when interacting with the environment, if it is redundant with respect to the task degrees of freedom (DOFs) at the endpoint. Then it is demonstrated that if the mobile closed chain assumes a number of configurations, then loop consistency equations permit joint angle readings; endpoint sensing is not required.

N91-17544# Brookhaven National Lab., Upton, NY. Dept. of Nuclear Energy.

ADVANCED HUMAN-SYSTEM INTERFACE DESIGN REVIEW GUIDELINES

JOHN M. OHARA 1990 18 p Presented at the 18th Water Reactor Safety Information Meeting, Gaithersburg, MD, 22-24 Oct. 1990

(Contract DE-AC02-76CH-00016)

(DE91-005439; BNL-NUREG-45454; CONF-9010185-16) Avail: NTIS HC/MF A03

Advanced, computer-based, human-system interface designs are emerging in nuclear power plant (NPP) control rooms. These developments may have significant implications for plant safety in that they will greatly affect the ways in which operators interact with systems. At present, however, the only guidance available to the U.S. Nuclear Regulatory Commission (NRC) for the review of control room-operator interfaces, NUREG-0700, was written prior to these technological changes; therefore, it is not designed to address them. The objective of the project reported in this paper is to develop an Advanced Control Room Design Review Guideline for use in performing human factors reviews of advanced operator interfaces. This guideline will be implemented, in part, as a portable, computer-based, interactive document for field use. The paper describes the overall quideline development methodology, the present status of the document, and the plans for further guideline testing and development. DOE

N91-17545# Anacapa Sciences, Inc., Fort Rucker, AL.
TASK ANALYSIS AND WORKLOAD PREDICTION MODEL OF
THE MH-60K MISSION AND A COMPARISON WITH UH-60A
WORKLOAD PREDICTIONS. VOLUME 2: APPENDIXES A
THROUGH G Interim Report, Dec. 1988 - Apr. 1990
CARL R. BIERBAUM and DAVID B. HAMILTON Oct. 199

For this research, a mission scenario was used to conduct a comprehensive task analysis for MH-60K operations. The analysis used a top-down approach to identify 5 phases, 15 segments, 71 functions, and 230 tasks for the mission. Also, the crewmember performing each task was identified, and estimates of the task duration and the sensory, cognitive, and psychomotor workload associated with the tasks were derived. The mission/task/workload analysis data were used to develop a computer model of workload for MH-60K crewmembers. The model used a bottom-up approach to build mission functions from tasks and mission segments from functions. Decision rules were written to specify the procedure for combining tasks into functions and functions into segments. The model permitted an analysis of total workload experienced by the pilot and copilot in the performance of both sequential and concurrent tasks. The predicted workload for the MH-60K pilot and copilot was compared to the UH-60A baseline workload prediction to determine the impact of the MH-60K advanced technology. The comparison indicated very little difference in the predicted workload for the pilot and lower predicted workload for the copilot in the MH-60K.

N91-17546# Idaho National Engineering Lab., Idaho Falls. EXAMINING HUMAN-SYSTEM INTERACTIONS: THE HSYS (HUMAN SYSTEM) METHODOLOGY

SUSAN G. HILL, JÉRRY L. HARBOUR, CHRISTOPHER SULLIVAN, and BRUCE P. HALLBERT 1990 5 p Presented at the 34th Human Factors Society Conference, Orlando, FL, 8-12 Oct. 1990 (Contract DE-AC07-76ID-01570)

(DE91-006150; EGG-M-89088; CONF-9010155-4) Avail: NTIS HC/MF A01

The human-system methodology (HSYS) is a model-based methodology developed to examine the many factors which influence human-system interactions. HSYS is built around a linear model of human performance, called the Input-Action model, which describes five sequential steps: Input Detection, Input Understanding, Action Selection, Action Planning, and Action Execution. HSYS is structured in an hierarchical tree which presents a logical structure for examining potential areas where human performance, hardware or other system components are less than adequate. The HSYS tree consists of five major branches which correspond to the five major components of the Input-Action model. Initial validation was begun by studying accident reports via HSYS and identifying sources of error. The validation process has continued with accident investigations in operational settings.

N91-18077# Military Airlift Command, Scott AFB, IL. AIRCREW FATIGUE COUNTERMEASURES

STEPHENS F. MCCAULEY In AGARD, Progress in Military Airlift 6 p Dec. 1990

DOE

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Since the earliest days of aviation, there have been aircraft accidents (now referred to as flight mishaps). In earlier times, mechanical malfunctions were blamed for the greater number of mishaps. Engineering and technological advances, however, have since lowered the likelihood of machine-induced mishaps. Now, the man part of the equation (in a chain of events leading to a mishap) is far more likely to be the primary cause. Thus, as aircraft are made more durable, reliable, and better able to sustain increased workloads, the humans who operate them must find ways to adapt or cope with the greater demands which result from improved machine capability. The bottom line question for

today surfaces as: What causes crewmembers to commit errors in judgment, performance, or perception, and how might the influences of such causes be reduced. Progress in the field of human factors (HF) analysis has revealed some solutions while advancing the fundamental goal of flight safety - mishap prevention. The impact of HF studies on mishap prevention is clarified and summarized and how aircrew fatigue is a common denominator among HF elements is shown. Accepted techniques for combating and coping with fatigue are listed. Finally, recommendations on how to maintain operational awareness of aircrew fatigue considerations are proposed.

N91-18078# Military Airlift Command, Scott AFB, IL. Test and Evaluation Div.

AIRCREW EYE/RESPIRATORY PROTECTION: A MILITARY AIRLIFT COMMAND PERSPECTIVE

JAMES SOUSA In AGARD, Progress in Military Airlift 9 p Dec 1990

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The effort of the Military Airlift Command (MAC) and the Air Force System Command (AFSC) to improve aircrew eve/respiratory protection (AERP) in the chemical defence environment is summarized. The significant effort to plan the concept, manage the acquisition, design the system, test the system, and redesign the system to meet the MAC requirements is discussed. The MAC mission to conduct and support operations remains the same during war and peacetime and despite the presence of chemical agents. An effective AERP system is needed to support the worldwide operations. The ongoing test effort has uncovered important problems and challenges to overcome. However, after hundreds of ground and over 50 flight test hours in the MAC mission environment, solutions are on the way. More challenges exist now, but the numerous hurdles already cleared have prepared a way to proceed. Author

N91-18127*# Colorado Univ., Boulder. METHODS FOR THE DEVELOPMENT OF A BIOREGENERATIVE LIFE SUPPORT SYSTEM

MICHELLE GOLDMAN, SHAWN GOMEZ, and MIKE VOORHEES In USRA, Proceedings of the 6th Annual Summer Conference: NASA/USRA University Advanced Design Program p 41-47 Nov. 1990 Sponsored by NASA, Ames Research Center Avail: NTIS HC/MF A14 CSCL 06/11

Presented here is a rudimentary approach to designing a life support system based on the utilization of plants and animals. The biggest stumbling block in the initial phases of developing a bioregenerative life support system is encountered in collecting and consolidating the data. If a database existed for the systems engineer so that he or she may have accurate data and a better understanding of biological systems in engineering terms, then the design process would be simplified. Also addressed is a means of evaluating the subsystems chosen. These subsystems are unified into a common metric, kilograms of mass, and normalized in relation to the throughput of a few basic elements. The initial integration of these subsystems is based on input/output masses and eventually balanced to a point of operation within the inherent performance ranges of the organisms chosen. At this point, it becomes necessary to go beyond the simplifying assumptions of simple mass relationships and further define for each organism the processes used to manipulate the throughput matter. Mainly considered here is the fact that these organisms perform input/output functions on differing timescales, thus establishing the need for buffer volumes or appropriate subsystem phasing. At each point in a systematic design it is necessary to disturb the system and discern its sensitivity to the disturbance. This can be done either through the introduction of a catastrophic failure or by applying a small perturbation to the system. One example is increasing the crew size. Here the wide range of performance characteristics once again shows that biological systems have an inherent advantage in responding to systemic perturbations. Since the design of any space-based system depends on mass, power,

and volume requirements, each subsystem must be evaluated in these terms. Author

N91-18128*# Florida Univ., Gainesville. IMPLEMENTATION OF SENSOR AND CONTROL DESIGNS FOR BIOREGENERATIVE SYSTEMS

In USRA, Proceedings of the 6th Annual Summer Conference: NASA/USRA University Advanced Design Program p 49-52 Nov. 1990

Avail: NTIS HC/MF A14 CSCL 06/11

The EGM 4000/4001 Engineering Design class is an interdisciplinary design course that allows students to experience the design process. The projects involved the design of sensors and subsystems of a closed-loop life support system (CLLSS) with special emphasis on the Controlled Ecological Life Support System (CELSS) currently being developed at Kennedy Space Center (KSC) by NASA. To understand the work performed by the students, one must understand the purpose and concept of a CLLSS system. In the years to come, NASA will be constructing Moon bases and sending astronauts to other worlds on extended space missions. In order to support the crews, unreasonably large quantities of supplies would have to be sent from Earth. These supplies would be difficult to transport and require large holds. To remedy this problem, NASA plans to incorporate crops into the spacecraft. These crops would supply food for the crews, as well as provide beneficial psychological side effects. In addition, the plants would recycle the air and human waste and provide oxygen and water for the humans. The students in the design class were to work on supporting this project. In order to do this successfully, the course was separated into two phases. The first semester involved studying the various aspects of a CLLSS to determine sensing needs and develop ideas. The second semester involved first determining which of the ideas were most promising. Specific sensors were then designed and tested under laboratory conditions with promising results. Finally, recommendations for further development were proposed. Atmosphere and temperature control, nutrient delivery, plant health and propagation, and resource recycling are discussed. Author

N91-18137*# Kansas State Univ., Manhattan. AUTOMATION OF CLOSED ENVIRONMENTS IN SPACE FOR HUMAN COMFORT AND SAFETY

In USRA, Proceedings of the 6th Annual Summer Conference: NASA/USRA University Advanced Design Program p 99-103 Nov. 1990

Avail: NTIS HC/MF A14 CSCL 06/11

The Environmental Control and Life Support System (ECLSS) for the Space Station Freedom and future colonization of the Moon and Mars presents new challenges for present technologies. Current plans call for a crew of 8 to live in a safe, shirt-sleeve environment for 90 days without ground support. Because of these requirements, all life support systems must be self-sufficient and reliable. The ECLSS is composed of six subsystems. The temperature and humidity control (THC) subsystem maintains the cabin temperature and humidity at a comfortable level. The atmosphere control and supply (ACS) subsystem insures proper cabin pressure and partial pressures of oxygen and nitrogen. To protect the space station from fire damage, the fire detection and suppression (FDS) subsystem provides fire sensing alarms and extinguishers. The waste management (WM) subsystem compacts solid wastes for return to Earth, and collects urine for water recovery. Because it is impractical, if not impossible, to supply the station with enough fresh air and water for the duration of the space station's extended mission, these elements are recycled. The atmosphere revitalization (AR) subsystem removes CO2 and other dangerous contaminants from the air. The water recovery and management (WRM) subsystem collects and filters condensate from the cabin to replenish potable water supplies, and processes urine and other waste waters to replenish hygiene water supplies. These subsystems are not fully automated at this time. Furthermore, the control of these subsystems is not presently integrated; they are largely independent of one another. A fully integrated and automated ECLSS would increase astronauts' productivity and contribute to their safety and comfort. The Kansas State University Advanced Design Team is in the process of researching and designing controls for the automation of the ECLSS for Space Station Freedom and beyond. The approach chosen to solve this problem is to divide the design into three phases. The first phase is to research the ECLSS as a whole system and then concentrate efforts on the automation of a single subsystem. The AR subsystem was chosen for our focus. During the second phase, the system control process will then be applied to the AR subsystem.

Author

N91-18150*# Puerto Rico Univ., Rio Piedras. School of Architecture.

HABITABILITY: CAMELOT 4

W. ALEQUIN, A. BARRAGAN, M. CARRO, F. GARCIA, I. GONZALEZ, J. A. MERCADO, N. NEGRON, D. LOPEZ, L. A. RIVERA, M. RIVERA et al. /n USRA, Proceedings of the 6th Annual Summer Conference: NASA/USRA University Advanced Design Program p 187-193 Nov. 1990

Avail: NTIS HC/MF A14 CSCL 06/11

During 1988 to 1989 the NASA/USRA Advanced Design Program sponsored research and design efforts aimed at developing habitability criteria and at defining a habitability concept as a useful tool in understanding and evaluating dwellings for prolonged stays in extraterrestrial space. The Circulating Auto sufficient Mars-Earth Luxurious Orbital Transport (CAMELOT) was studied as a case in which the students would try to enhance the quality of life of the inhabitants by applying architectural design methodology. The study proposed 14 habitability criteria considered necessary to fulfill the defined habitability concept, which is that state of equilibrium that results from the interaction between components of the Individual Architecture Mission Complex, which allows a person to sustain physiological homeostatis, adequate performance, and acceptable social relationships. Architecture, design development, refinements and revisions to improve the quality of life, new insights on artificial gravity, form and constitution problems, and the final design concept are covered.

N91-18158*# Wisconsin Univ., Milwaukee. Dept. of Architecture.

GENESIS LUNAR OUTPOST: AN EVOLUTIONARY LUNAR HABITAT

GARY T. MOORE, comp., DINO BASCHIERA, JOE FIEBER, and JANIS MOTHS *In* USRA, Proceedings of the 6th Annual Summer Conference: NASA/USRA University Advanced Design Program p 241-254 Nov. 1990

Avail: NTIS HC/MF A14 CSCL 06/11

Students at the University of Wisconsin-Milwaukee Department of Agriculture undertook a series of studies of lunar habitats during the 1989 to 1990 academic year. Undergraduate students from architecture and mechanical and structural engineering with backgrounds in interior design, biology and construction technology were involved in a seminar in the fall semester followed by a design studio in the spring. The studies resulted in three design alternatives for lunar habitation and an integrated design for an early stage lunar outpost.

N91-18582# Joint Publications Research Service, Arlington, VA. PSYCHOLOGICAL ASSESSMENT OF HORIZON INDICATORS IN PLANES Abstract Only

V. A. PONOMARENKO, V. V. LAPA, and N. A. LEMESHCHENKO In its JPRS Report: Science and Technology. USSR: Life Sciences p 17 26 Sep. 1990 Transl. into ENGLISH from Psikhologicheskiy Zhurnal, Moscow (USSR), v. 11, no. 2, Mar.-Apr. 1990 p 37-46 Avail: NTIS HC/MF A04

Psychological studies were conducted on optimum horizon indicators in view of recent findings demonstrating that more than 20 percent of airplane accidents are attributed to spatial disorientation, and that this number is increasing. Trials conducted with flight simulators demonstrated that a display depicting an aircraft in flight against a stationary horizon, i.e., depiction of spatial relationship in a geocentric system of coordinates, facilitates spatial perception in comparison with a moving-horizon display. The key

disadvantage of the latter method lies in the requirement for additional information processing necessary for reorientation of the information into geocentric coordinates.

Author

N91-18602# National Academy of Sciences - National Research Council, Washington, DC. Committee on Human Factors.

BASIC RESEARCH IN HUMAN FACTORS Interim Report, 1984

HAROLD VANCOTT and ELIZABETH NEILSEN Jul. 1990 43 p

(Contract MDA903-38-C-0031)

(AD-A226318; ARI-RN-90-78) Avail: NTIS HC/MF A03 CSCL 23/2

This report outlines the purpose, membership, and recent activities of the Committee of Human Factors. It summarizes current studies in the areas of human performance models, multicolored displays, distributed decision making, expert systems, and aging. The report also discusses reports from 1984 through 1988 that represent the areas listed above.

 $\mbox{N91-18603$^{\mbox{\tiny $^{\circ}$}}}\mbox{ }\mbox{National Aeronautics and Space Administration, Washington, DC.}$

SPACESUIT GUIDEBOOK

1991 24 p

(NASA-PED-117; NAS 1.84:117) Avail: NTIS HC/MF A03 CSCL 06/11

This guidebook is designed to supplement the Spacesuit wall chart (WAL-114) published by the Education Affairs Division, January 1990. The wall chart depicts Astronaut Bruce McCandless on his historic first untethered spacewalk using the manned maneuvering unit. He flew on Shuttle mission 41-B, and ventured 100 meters for the Shuttle's cargo bay and returned safely. This guidebook explains in depth the elements depicted on the wall chart in see-through and cut-away perspectives. Together the wall chart and guidebook show as well as explain the inside workings of the spacesuit and its various components. Forty separate elements are identified with an accompanying numerical legend. Those elements are further explained in this guidebook along with their functions and how they work in relation to other elements. Additional chapters discuss essential components of the spacesuit such as the primary life support system and the manned maneuvering unit, and the method for donning the spacesuit.

Author

N91-18604# Lawrence Livermore National Lab., CA. Systems and Human Performance.

HUMAN ENGINEERING DESIGN CONSIDERATIONS FOR THE USE OF SIGNAL COLOR ENHANCEMENT IN ASW DISPLAYS WILLIAM W. BANKS Nov. 1990 89 p (Contract W-7405-ENG-48)

(DE91-004949; UCRL-ID-105261) Avail: NTIS HC/MF A05

The Lawrence Livermore National Laboratory (LLNL) was requested to examine and define man-machine limits as part of the Office of Naval Technology's High Gain Initiative program (HGI). As an initial investigative area, LLNL's Systems and Human Performance effort focused upon color display interfaces and the use of color enhancement techniques to define human and system interface limits in signal detection and discrimination tasks. The knowledgeable and prudent use of color in different types of display is believed to facilitate human visual detection, discrimination and recognition in complex visual tasks. The consideration and understanding of the complex set of interacting variables associated with the prudent use of color is essential to optimize human performance, especially in the ASW community. The designers of advanced display technology and signal processing algorithms may be eventually called upon to present pre-processed information to ASW operators and researchers using the latest color enhancement techniques. These techniques, however, may be limited if one does not understand the complexity and limits of human information processing which reflects the assessed state of knowledge relevant to the use of color in displays. The initial sections of this report discuss various aspects of color presentation and the problems typically encountered, while the last section deals with a specific research proposal required to further our understanding and proper use of color enhancement methods.

DOE

N91-18605# National Aerospace Medical Centre, Soesterberg (Netherlands).

ENVIRONMENTAL FACTORS INFLUENCING FLIGHT CREW PERFORMANCE

M. SIMONS 1990 14 p Presented at ICAO Human Factors Seminar, Leningrad, USSR, 3-7 Apr. 1990 (ETN-91-98698) Avail: NTIS HC/MF A03

Developments in commercial aviation have changed the pilot's task to that of a flight systems manager. In this task optimum vigilance is required. It is anticipated that the performance of the modern pilot might be impaired by the cumulative effects of frequent disturbance of sleep and prolonged exposure to mild hypoxia, low relative humidity, ozone, and noise. The effects of loss of sleep, lower cabin pressure, low relative humidity, ozone, and noise on a pilot's performance is discussed. Research on the effects of the combination of environmental factors on performance is recommended. Such research should include controlled studies under cockpit environmental conditions, employing over time assessment of psychological performance, and using tasks that are representative for the task of a modern pilot. Conditions to be included in such a study are given.

N91-18606# National Aerospace Medical Centre, Soesterberg (Netherlands). Dept. of Research and Development.

COCKPIT-ENVIRONMENTAL FACTORS DURING

LONG-RANGE FLIGHTS

M. SIMONS Apr. 1989 52 p Sponsored by Civil Aviation Authority, Netherlands

(REPT-89-02-RLD; ETN-91-98699) Avail: NTIS HC/MF A04

As a result of the increase of the average sector length flown by most international airlines, flight crew is exposed to the aircraft cabin environment for a longer period of time. Scientific literature is reviewed with respect to the effects of prolonged (greater than 8 hours) exposure to cockpit environmental conditions on well being and performance of flight crew. The effects of cabin pressure, relative humidity, ozone, cosmic radiation, noise and vibration are discussed in detail. Recommendations for future studies are formulated.

N91-19014*# New Mexico Highlands Univ., Las Vegas. Dept. of Engineering Technology.

BIOREGENERATIVE LIFÉ SUPPORT

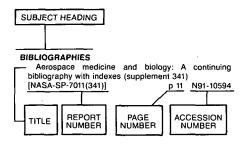
BILL TAYLOR In Alabama Univ., Research Reports: 1990 NASA/ASEE Summer Faculty Fellowship Program 5 p Oct. 1990

(Contract NGT-01-002-099)

Avail: NTIS HC/MF A16 CSCL 06/11

Bioregenerative life support systems utilize plant growth for food, water, and atmosphere revitalization. Simulation studies of a simplified model are presented that suggest survivability in the face of partial plant growth chamber failure. Simulation studies demonstrate the potential for a bioregenerative life support system on an extended mission. In addition to robustness and survivability in terms of the food supply, the plant growth chamber produces exactly the right amount of oxygen for the crew's metabolic needs. The amount of water taken up by the plants during food production is balanced by the crew's metabolic water production.

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of document content, a title extension is added, separated from the title by three hyphens. The accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence.

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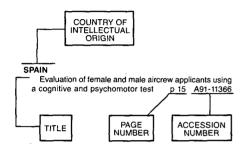
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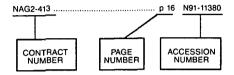
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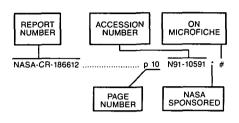




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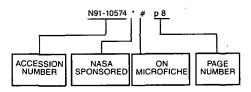


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